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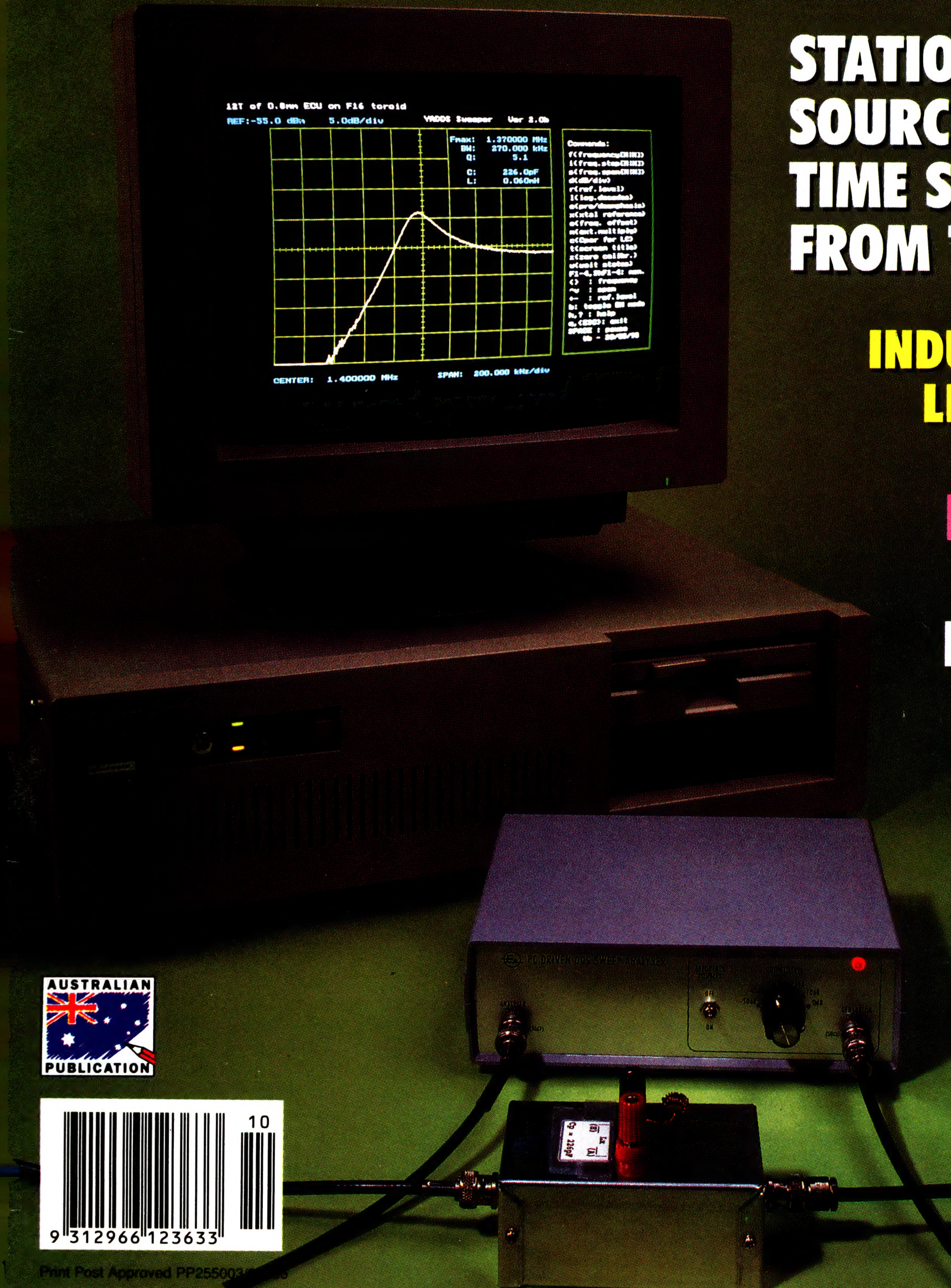

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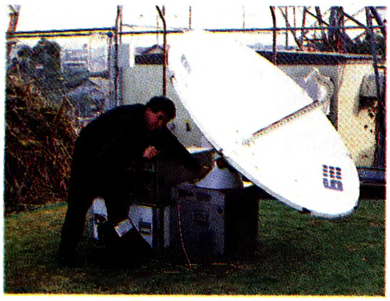
AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

Film hard to find...

Very little film equipment was in evidence at the recent SMPTE show — but many new video editing systems using hard disk storage. Barrie Smith's report starts on page 6.

Tested with a 'fly away'



After we'd tried out the Unaohm EP315A Field Strength Meter for this issue, Michael Landy of the Nine Network tested it with a 'fly away' satellite terminal. His findings are included in our review; see page 104.

On the cover

As well as proving very handy indeed for displaying the frequency response of RF filters and amplifiers, our new PC-Controlled Sweeper can also be used to measure the inductance and 'Q' of coils and transformers. Its construction and use are described in the article starting on page 76. (Photo by Trevor Creighton)

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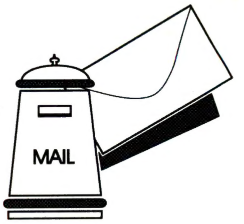
LETTERS TO THE EDITOR



Father Archibald Shaw

I read with interest the article on Father Archibald Shaw in Australia's Radio Pioneers. I had a keen interest in this article, because I am the historian of the Passionist Community he joined, and am also very interested in radio. I had the call VK3MFR, but just recently changed to VK5MFR following a transfer.

Regrettably I cannot assist you with too much information, except for the fact that Archibald Shaw joined the Passionists on the 4th of April 1892 and was made a novice on the 15th of May 1892. He was then voted unsuitable for study for the Priesthood on October the 11th, 1892, but he was offered a chance to become a Brother with the Passionists, which he accepted, as he never made Profession a year after, it is assumed that he left the Congregation during the year of Novitiate.

My own thinking, not based on records, is that he missed out on being a Priest with us possibly on poor academic grounds, rather than the limp you mention. This was sometimes the case with suitable students who had difficulties with studies. The study demands on a Brother were much reduced at that time. If the physical disability was the reason, this would have hindered his acceptance as a Brother as well.

So it looks like we missed out, as a Congregation, on two grounds: one that he was very capable of study, and two that he proved, in later life, to achieve the Priesthood.

Our place in Goulburn, called Mary's Mount, was sold in the early 1970's but the Congregation is found in most States of Australia.

I thank you for your recognition of our Congregation, and agree that the influence of a Missioner may well have been the source of Archibald's vocation; there were some other quite notable residents of Goulburn who joined at that time.

We had a well established house in Goulburn in 1892. I lament that the powers to be did not see the real talent that he had, because if they had, I may have had an easier task trying to upgrade my Novice call!

Cheers and thanks,

Br Jeff Daly, C.P.
Glen Osmond, SA.

PC-driven ECG

I have just read your PC Driven ECG project in the July issue and the alarm bells have begun ringing loud and clear, Graham Cattley is certainly wise to suggest that under no circumstances should the user commit the folly of supplying the circuit from or connecting it to the mains. But I wonder if he has realised that the 9V battery supply is nevertheless a potentially lethal current source when associated with electrodes connected to the human body.

Your readers should be made aware that any inadequacies by reduction of skin resistance or puncturing of the skin, can have dire effects. This is particularly the case if two or more electrodes are applied to the thorax.

What concerns me about Graham's design is that the insulation of the inputs appears to be entirely due to the input impedance of the op-amps. If the failure mode of one of these op-amps includes input impedance breakdown, someone could be in trouble. If my interpretation of the circuit diagram is correct it may also be possible to commit a DIN plug wiring error which offers 9V to the electrodes.

Some years ago I carried out research into cardiac arrests associated with swimming pools and ECG machines. The connection between pools and ECG machines is that they involve chemicals capable of removing the surface body oils. Along the way I made some interesting and relevant discoveries which impact on the construction of Graham's project.

Whilst it is generally accepted that a hand to hand current of around 15mA will be required to fibrillate the heart, the proportion of this current actually passing through the heart itself is very small. This arises on account of the current distribution through the thorax which has a large cross section.

The currents associated with the biological (the one you were born with) heart pacemaker measure in the order of micro-amps. The reason that modern electronic heart pacemakers are so compact is the minuscule energy required at each pulse and hence the compact battery size. By the same token it requires only a few micro-amps of stray current from an external source to totally confuse the heart.

Graham is perfectly correct when he points out that most of the human body's resistance to the passage of electricity occurs at the surface of the skin. In fact the resistance is largely due to the insulating effects of body oils. This is the reason that electric shocks sometimes cause burns at the entry and exit points, but have minimal internal effect. The blood with all its dissolved salts forms a very nice electrolyte capable of transporting electrons with relative ease. In the USA (and some extent Australia and Britain) during the late sixties and early seventies it was realised that an all too significant number of cardiac arrests occurred whilst the patient was connected to an ECG machine. It soon transpired that inadequate insulation of the ECG machine electrodes combined with the oil removing gel applied to the skin under the electrode was the cause!!! What is more, it was demonstrated that cardiac arrest could be the consequence of connecting two gelled electrodes to a 1.5V cell and the thorax of a suitably unsuspecting volunteer!

Needless to say, the whole subject of enforceable electrical manufacturing and wiring standards for medical premises and diagnostic equipment immediately underwent a major rethink. Suffice it to say that the relevant standards are now much more stringent than for domestic, commercial or industrial premises. In your ECG machine's case, I would be much happier if the supply rails and electrodes were wired to quite separate plugs and the input impedances of the electrodes had been fixed at a high level by means of suitable resistors, insulation, etc.

I trust this information is of assistance to you and your readers.

Ron Jacobs, CPEng,
Consulting Engineer,
East Oakleigh, Vic.

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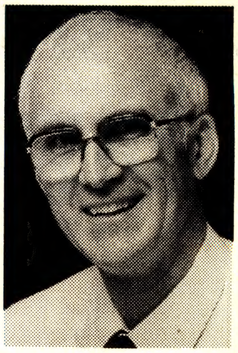
EDITORIAL VIEWPOINT



Let's not make the same mistakes with digital TV!

One of the characteristics possessed by many technologists — including electronics engineers — is that they always want to 'do it *their* way', because they believe they know how to do it better than anyone else. It's a characteristic that has both good and bad aspects...

On the good side, this unwillingness to 'do it in the same old way' or 'the way everybody else does it' has often led to the most important and valuable developments in technology. In fact it's an almost essential requirement for true innovation. We probably wouldn't have many of today's high-tech wonders if there hadn't been engineers who believed that *they* could do it better.

But the flip side of the same characteristic is that it often lumbers us with a number of competing technological 'solutions' for any given problem. And when this is combined with other characteristics like nationalism and economic myopia, it can result in fragmented markets, high manufacturing costs and unnecessary barriers to international communication and cooperation.

The world's existing 'analog' television systems are a good case in point. Quite apart from having three main systems — NTSC, PAL and SECAM — numerous minor variations have been developed over the years as well. All of which has produced something of a nightmare, when it comes to global programme interchange and efficient manufacture of receivers, monitors and VCRs.

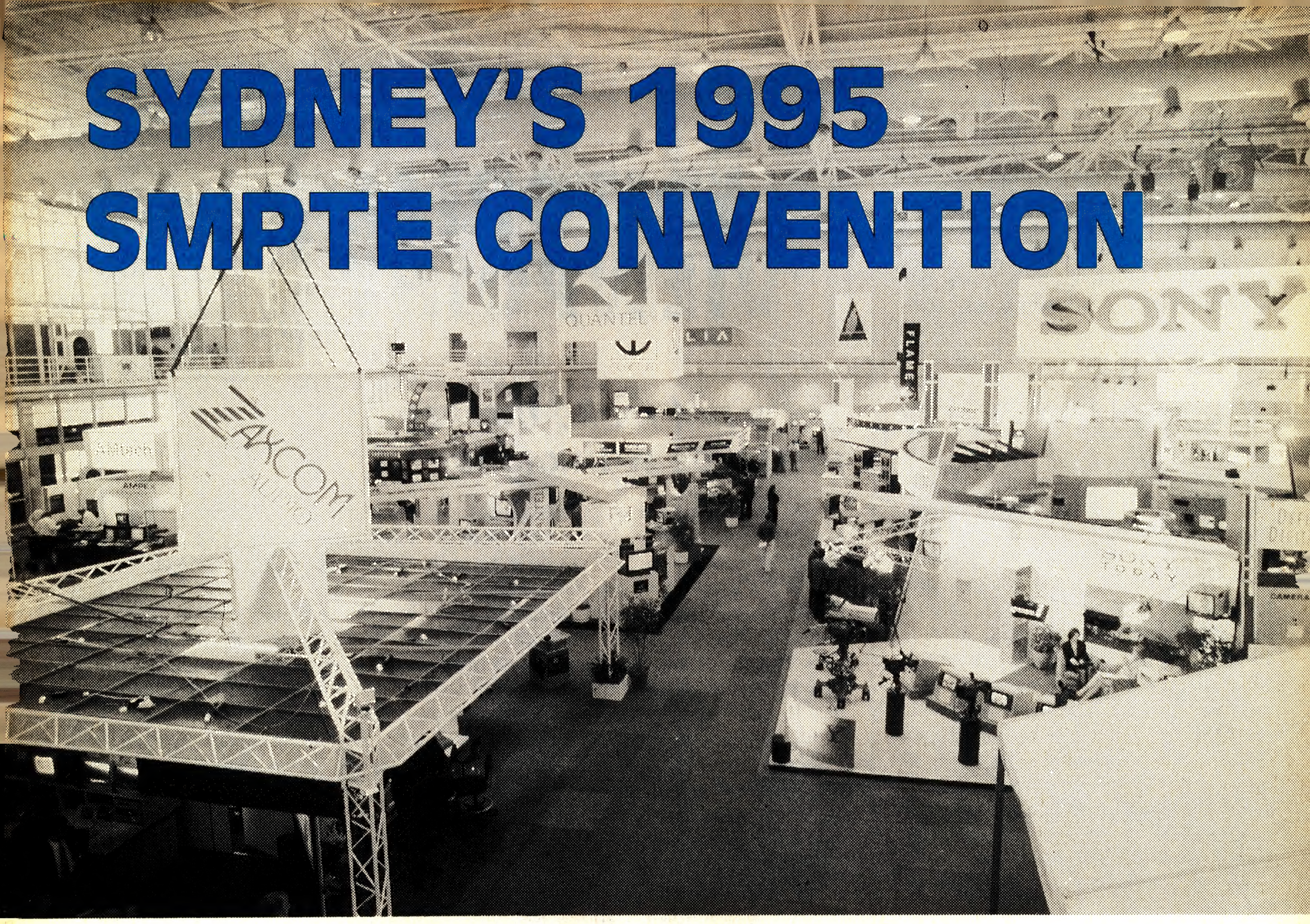
It's been obvious for some time now that the future of video and television, as with audio, is going to be a digital one. And one of the many benefits of this changeover to digital technology is the potential to achieve an integrated, global transmission and distribution system which is at the same time both hierarchical in terms of image definition, and 'open ended' in terms of at least medium-term future development. For example the 'Grand Alliance' system developed in the USA allows not only for video transmission or distribution in either medium or high definition form, but also the use of receivers/monitors designed to extract almost any desired level of image definition, up to the level being transmitted. Cheap portable sets can deliver a relatively low-res image, while expensive 'home theatre' models can provide a high quality HDTV image.

From reports I've seen, though, Europe's Digital Video Broadcasting group may have already decided against the adoption of this kind of system. Instead it looks like plumping for a fixed medium-resolution system, with receivers/decoders which would probably not be compatible with any future digital HDTV system. If this is true, what an unfortunate decision that could turn out to be!

Frankly, it sounds like yet another case of one bunch of technologists believing that *their* solution is best, even if it's different from and incompatible with that developed by many of their peers. And it could well result in the world missing an ideal opportunity to rationalise and simplify the technology for both distributing and displaying video/TV.

Jim Rowe

SYDNEY'S 1995 SMPTE CONVENTION



One of the trends evident at the Society of Motion Picture and Television Engineers' 1995 Convention and Exhibition in Sydney was the shrinking presence of magnetic tape formats, as the use of digital hard disk drives makes inroads into video editing and production. In this report Barrie Smith also notes that film had almost completely disappeared, in favour of video...

by BARRIE SMITH

When you amble around an exhibition of multi-millions of dollars worth of electronic hardware and pass a married couple with a baby-laden stroller, then step aside as a pair of orange-hued Hari Krishna devotees swish past, you begin to think — am I really at the Society of Motion Picture & Television Engineers 1995 Australian event?

For a number of reasons not at first obvious, the 'down under' 1995 SMPTE conference and exhibition held in Sydney early in July was a somewhat sombre, if not downright odd, affair.

The first local convention was in 1984, and SMPTE had been held in alternate years until 1994; this year's appearance was timed to avoid a clash with Broadcast Asia 1996, and SMPTE will return in 1997. Which dislocation shows the importance of the Asian event to the equipment merchandisers (mostly from the US and Japan) — and, worryingly, the relative unimportance of the Australian scene.

The show was also virtually 99.99% film free. Not seen were our friends from Kodak, nor were the burgomeisters from Agfa (the latter having dropped 35mm motion picture negative production). No equipment stands. No cameras — except for one forlorn veteran 35mm Arriflex, inelegantly propped outside Silicon Graphics' stand...

And glowing brightly in centre stage was the huge Sony stand, packed to the brim with edit suites, cameras and audio gear.

Video — wall to wall — was strongly in evidence at SMPTE 1995. Just to prove that video production and broadcast are arenas of change, evidence was also at hand that three new recording formats are about to descend upon the industry's cameramen, editors and engineers.

As usual, the event was run in two largely parallel streams: the equipment exhibition in one hall, for four days — and a three-day talkfest in one of Darling Harbour's vast auditoria.

Linear? Nonlinear?

Until video came along, most film editors used to impale the film clips needed for editing onto pins (actually beheaded nails) protruding from a wooden spar; the excess length of film was then tumbled into a cloth-lined basket beneath. To join the clips together, clear Mylar tape was used — easy to apply and remove if the join was to be remade. Using this system, alternate edits could easily be made; and not a frame lost.

Video, until recent times, was not so easy to edit in a random fashion. But video is now king, and even film is now transferred to an electronic medium for the edit.

So there was a need perceived for an electronic method of random editing film clips and video scenes.

Quantel, happy now that its digital film Domino system is about to be installed in Sydney.

Enter the random access or 'nonlinear' editing suite. A buoyant market has developed, now supplied by a number of companies who have injected computer technology, leading to the visual and aural components of the original being transferred to large capacity hard drives.

The main players on the Australian market are Lightworks, Avid and Media 100. In spite of Avid having 'the name' in the field, the Media 100 has scored in sales, with 75 sold into Australian companies in the last 12 months. Using a Mac platform it outputs SP Betacam quality, and costs a mere fraction of tape-based online systems.

Mark Richards of Adimex, who distribute the unit, pointed out that "there is resistance by traditional broadcast people" to the idea of a broadcast quality video signal being handled by a desktop computer.

Richards added: "Instead, control of the means of production has moved to the people with the creative skills", and "That's taking away the market from the traditional tape based systems suppliers".

Richards quoted a company engineer who felt that what users really want is uncompromised video and audio quality, with unlimited disk storage, unlimited numbers of video and audio tracks, unlimited special effects, in real time for free. And that's where the technology is going...

Disk storage is also invading video camera design. Avid has joined forces with Ikegami to produce Camcutter, a 'tapeless image acquisition' device. An early engineering example was on show. The front end is a conventional Ikegami HL57 camera, backed up by a signal processing unit, recording to a removable hard drive. At the show, Mark Norton of Avid US describes these as 'field packs':

"Each one of these things is a magazine that can record up to about 15-20 minutes worth of video and four tracks of audio. Quality? Well, it's kind of a subjective thing in some ways. You can call it Betacam quality if you wish. I'm not going to put that label on. ENG quality? Yep."

Left: The 'video wall' display on a rental company stand. Right: Silicon City, a presence here to support high end video and film producers using SGI systems.

Ikegami brought their camera expertise to the joint venture, while Avid brought their nonlinear editing expertise to the task.

Norton explained some powerful advantages that Avid's hard drive system has over tape: "One of them is instant playback of material you have just captured; another is that you can take the clips and edit them inside the camera. So if you shoot a few clips on, say a fire story, in no particular order, you choose your in and out points, and when you've built a small sequence you can go right to air from the camera."

The field packs are dust and moisture proof — and robust, as I noted when Mark Norton threw one to the ground. Capacity of each is 2.4GB on paired 2.5-inch drives. The launch of Camcutter is timed for the end of 1995.

Storage

In other areas of production and broadcasting, disk storage is moving in fast. Tektronix showed the Profile disk recorder, heart of the company's newsroom installation.

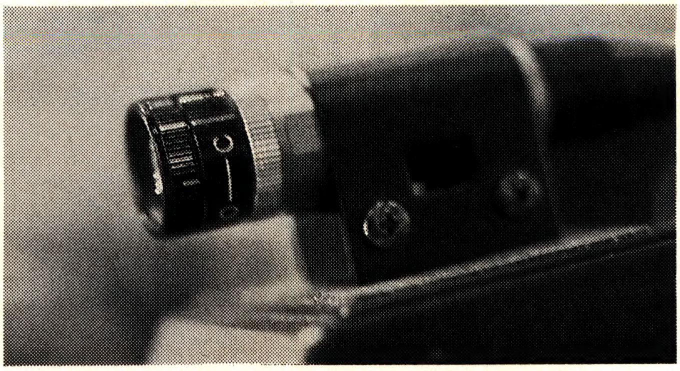
Profile is a four channel disk recording system for simultaneous record and playback. The capacity depends on the compression rate setting; using Motion JPEG at its highest level, it is possible to store nine hours of video and audio at Betacam SP quality. Each of the unit's hard drives can hold 4.2GB, expandable to a total of 24 drives.

Tektronix is currently working on a professional format of MPEG2, likely to be accepted as an SMPTE standard.

A world first for the Sydney SMPTE was the showing on the Amber Technology stand of the Belgian EVS company's slow motion device — as well as EVSU well accepted broadcast delay units.

In Live Slow Motion EVS have a 'new look' slow motion system. Disk capacity is anywhere between 15 minutes and three hours at 6:1 compression. The original recording takes place at 75fps; one system can accept the output of four cameras while simultaneously searching and replaying. Frame interpolation is used to smooth vision while, for the first time, the sound can also be used — as a normal speed replay.

A monument to the demise of tape? BASF's presence seemed to have a somewhat gloomy atmosphere...



Ikegami's pencil camera, using a 1/2 inch colour CCD to deliver 440,000 pixels plus genlocking.

The EVS Video Network Delay unit has the ability to delay incoming feeds — from a matter of seconds to tens of hours if needed. The unit on show had been loaned by Channel Seven Sydney, one of two used by the network for introducing delays to remote point relays — like half an hour for Adelaide and two hours for Perth.

Yet another application of the approach is the EVS Air Edit. Information coming into the system can be recorded and replayed, while simultaneously offering the ability to edit. This has been found to be very useful for Pay TV operators. Optus have just purchased six of these units for their incoming permanent satellite feeds, where they wish to remove US commercial breaks, and rearrange the programme 'on the fly'.

Fairlight, risen again from financial problems, were again at SMPTE — this time with their new MFX3, the company's answer to disk based multi-track audio recording and editing. Employing a new DSP architecture, the MFX3 is capable of simultaneously replaying 24 tracks from one hard drive.

Sales manager Graeme Rothwell claims the company is "doing very well in the Asian market" and is now established as the number one player in post production: "During 1994 we also opened up new offices in the UK and the US. Well established in Hollywood, we also have a very strong local market base."

'Forensic' audio

The Cedar range of audio restoration units continues to find applications. Newest, according to DW Productions man David Wickert, is a number of recent sales to the Australian Federal Police and New Zealand Police. What are they being used for, I asked — surveillance and detection purposes? Wickert prefers to use the term 'forensic'.

When this writer had the opportunity to meet Cedar's MD Gordon Reid three years ago, he was taken aback when I asked him if the company had plans to devise an image restoration scheme; he admitted that one was under development. Current news is that the Cambridge company has not moved onto a restoration system, primarily because there's too many other very successful and proven systems in use.

Ultra wide angle

At each SMPTE show there is usually a 'show pony' in the optics department. This year it was Canon's turn, with an ultra wide lens. The advent of 16:9 programming is calling for lenses to service both the wide screen and 4:3 formats, using a single CCD block.

The new lens, labelled J9ax5.2B, has a focal length range from 5.2 to 47mm. At 5.2mm the angle of view in 4:3 mode is given as 80.5°; if that is not enough, a wide extender can be added to

Left: Mitec's Peter Mirtschin with one of the firm's OB links. Right: Sony's impressive stand, with DSP equipped OB cameras.

bring the focal length to 4.4mm and a coverage of 90°!

Brisbane-based manufacturer Mitec is swiftly building a reputation as a supplier of OB links and domestic receiving antennae for MDS broadcasting. Possibly as a crowd puller the company also showed their Stumpcam camera and transmitter, concealed within a specially hollowed aluminium cricket stump.

Mitec's Peter Mirtschin pointed out the transmitter, roughly the size of a thumb. The radiated power is in the order of 60mW and range, with a 400mm antenna as used by Channel Nine, is one kilometre (line of sight).

When asked the 'loss rate' of stumps vs cameras, Mirtschin replied: "We've lost more stumps than we've lost transmitters. The electronics is more durable than the stump."

Ikegami also showed a mini camera — their PV-7A with a 1/2-inch CCD colour camera and 440,000 pixels. Hardly larger than a little finger, the camera's vision output offers genlock.

A demonstration of the new ultra-wide 5.2mm zoom lens from Canon.

Lighting products

The Miller company is another which enjoys a healthy export business. Its Australian designed and made tripods are now exported to 38 countries. The company has offices in the US and Japan, and will soon be opening one in Europe. 95% of the product goes overseas.

Miller's Nicholas Connell noted that tripods are getting lighter, due to the manufacturers of carbon fibre developing a lighter raw material. In spite of this, the company still manufactures wooden tripods, to service the sole area of demand — Australia.

Acceptance of the company's Balcar fluorescent studio lighting continues. One of its realised advantage over other fluoresecents is that the output can be mixed with current tungsten lighting — at 3200K. Other units are balanced to 5600K, so can be used with daylight.

Currently 15 TV stations throughout Australia are using the technology in their studios, the most recent one being the ABC/Fairfax Australian Information Media Pay TV setup at Gore Hill in Sydney.

Head to head

Films such as *Forrest Gump* and *Jurassic Park* have relied heavily on digital film systems to manipulate motion picture originated images and merge them with computer created animation. The input is film, the output is film — to the same quality level of any cinema screen in the world.

The two opposing systems are from Quantel with its Domino — and Kodak with Cineon. The approach is the same: original film is scanned by a high resolution telecine; once digitised, the images are processed and tweaked in massively powerful computer platforms, then finally output to a high quality film recorder.

At SMPTE it was learned that Australia's first Domino system was to be installed at Sydney computer graphics house Animal Logic — while an as-yet-unnamed conglomerate has ordered the Kodak Cineon device. The planned arrival time for both? September 1995. And the investment involved? Somewhere between $2-5 million apiece.

Silicon Graphics, generally recognised as the hardware and systems suppliers to the video and film industries, have now set up Silicon Studio in three Australian capitals — to look after people in the creative area who work with SGI technology. Perhaps all this activity is due to the impending Murdoch/20th Century Fox Studios ingestion of Sydney's Royal Agricultural Society's Showground, as a movie making centre...

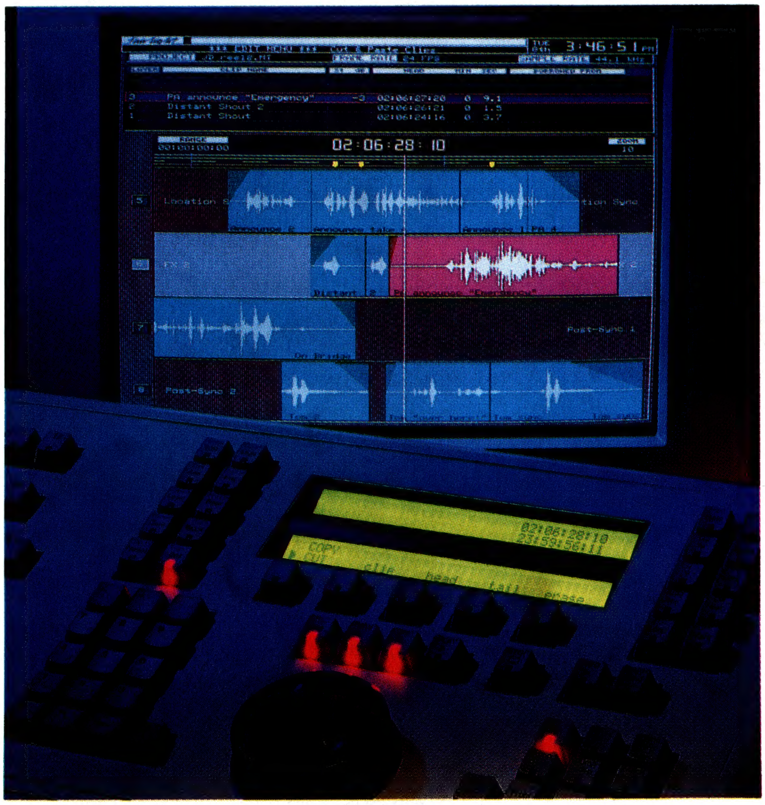
Sony impressive

Licking its corporate wounds after a recent massive dive in profits, Sony was running an impressive layout of gear.

Their new studio and OB cameras now employ the DSP technology, arising from Digital Betacam. One camera design uses interchangeable CCD blocks, so the camera can operate in either 16:9 or 4:3 format.

Also filling a major portion of the stand were Sony's solutions for the requirements of the TV station of the future. (Providing Pay TV hasn't killed them off!)

One area was an operating Journalist's Work Station, equipped with the company's new digital camcorder, employing 1/2-inch Betacam SX — a smaller, lighter and cheaper format than Digital or SP Betacam.



Fairlight's MFX3 audio workstation — bound to be another export winner.

The new format is recognition of the need for a cheaper and smaller digital acquisition format for ENG (Electronic News Gathering) and EFP (Electronic Field Production) purposes.

Panasonic and DVCPRO

Close by was another entry into the 'smaller is better' campaign, from Panasonic. The company's new format is DVCPRO, a 1/4-inch digital acquisition and production format.

Panasonic's Stuart Pointon stressed that DVCPRO's "primary aim is for digital acquisition — news, ENG and EFP. A very low cost, high quality format, it is viewed as delivering quality level with that of D1, D5 and Digital Betacam — and definitely better than SP Betacam."

On working demonstration were a camera, VCR and edit suite, all processing DVCPRO tapes. A compact field recorder with broadcast playback quality is available, about the size of a CD player. One of the cameras — 'Journocam' — weighs in at 2.5kg total. The tape itself is cigarette pack size, with a one-hour loading costing around $25.

The DVCPRO concept is the product of a consortium formed between Matsushita, Sony, Philips, Thomson, Hitachi, Toshiba, Mitsubishi, Sanyo and JVC. While the principle was initiated a few years ago, the actual work by Panasonic on its version took only 12 months from inception to the first engineering machine.

The price level is targetted to sit at around half that of SP Betacam for everything — replay machines, camcorders etc. In early tests, it was found that 10 generations from the original could be achieved with no artefacts produced. The NTSC version will be released about November, with PAL units appearing in March 1996.

JVC's Digital-S

Expected to find release in early 1996 is JVC's entry into the budget tape stakes. The 'prosumer' S-VHS format is the base for Digital-S. Predicted to come in at half the cost of Digital Betacam, the new format will still share 'many of the same subjective' features.

Interframe compression is deployed, along with metal particle tape; a VHS size cassette should contain 105 minutes of recording. Appearing at first will be an editing recorder/ player (able to replay S-VHS) and a docking recorder, with a dockable camera to hand within 12 months.

The Conference

Running virtually parallel with the exhibition were presentations of various papers by industry experts.

I attended the first session to find the spirit of free and open debate was very much alive. The topic? Pay TV.

Arraigned on stage like ducks at a shooting gallery were reps from Optus Vision, Telstra and Galaxy. Taking the opportunity for potshotting, many of the audience from the FTA arena took the chance to pick holes in the emerging (in this country) technology...

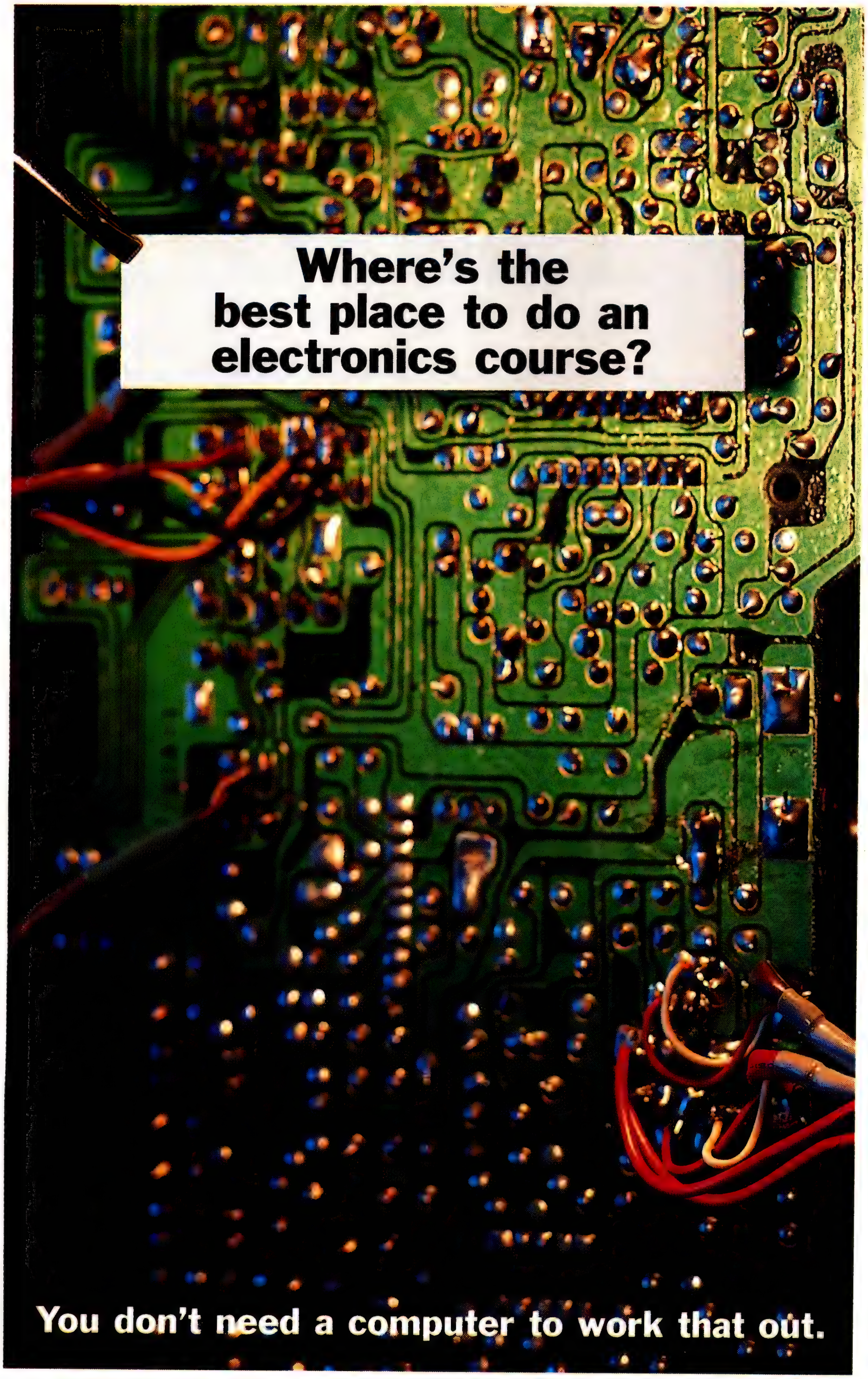
On other days topical subjects such as compression, file servers, nonlinear editing and digital film effects were covered by a variety of speakers.

Footnote

In quiet chats with various individuals, it appeared that the appearance of Pay TV on our shores has done wonders for local companies' balance sheets. Peter Amos of Amber commented that the new Pay operators' use of the new digital technology and processing systems (and such things as compression) were still being resisted by the FTA stations.

He added that an 'attitude change' in the Pay operators has led to the *operations* people controlling the choice of equipment, rather than the technical people.

Another person I talked to, one of Sony's sales force, expressed the feeling that the cable operators have provided a lot of business for equipment suppliers — but that it is a bubble which may well burst. ❖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Video & Audio: The Challis Report

THE PHILIPS FW17 'MONSTER MICRO' SYSTEM

This month our reviewer Louis Challis turned his attention and instruments on the FW17, flagship of the new range of 'micro' audio systems released by Philips Consumer Electronics. Dubbed the 'Monster Micro', the FW17 boasts thermostatic fan cooling and an impressive power output considering its very compact size.

Whilst the most recent Electronic Industries Association Consumer Electronics Group report states that "Most consumer goods have shown lower sales versus one year ago", I note that there has been a sales growth in *some* consumer electronic products.

The product areas which have displayed the most significant growth in the USA have been in the field of large screen TV sets, as well as sales of mini and micro hifi systems.

When Sony's sister company Aiwa introduced the first mini sound system around 20 years ago, most commentators shrugged the development off as being another passing trend. Of course, those commentators proved to be wrong, and you only have to walk into any electrical shop or specialist dealer to realise that mini and micro systems now constitute more than half of all audio sound system sales in Australia.

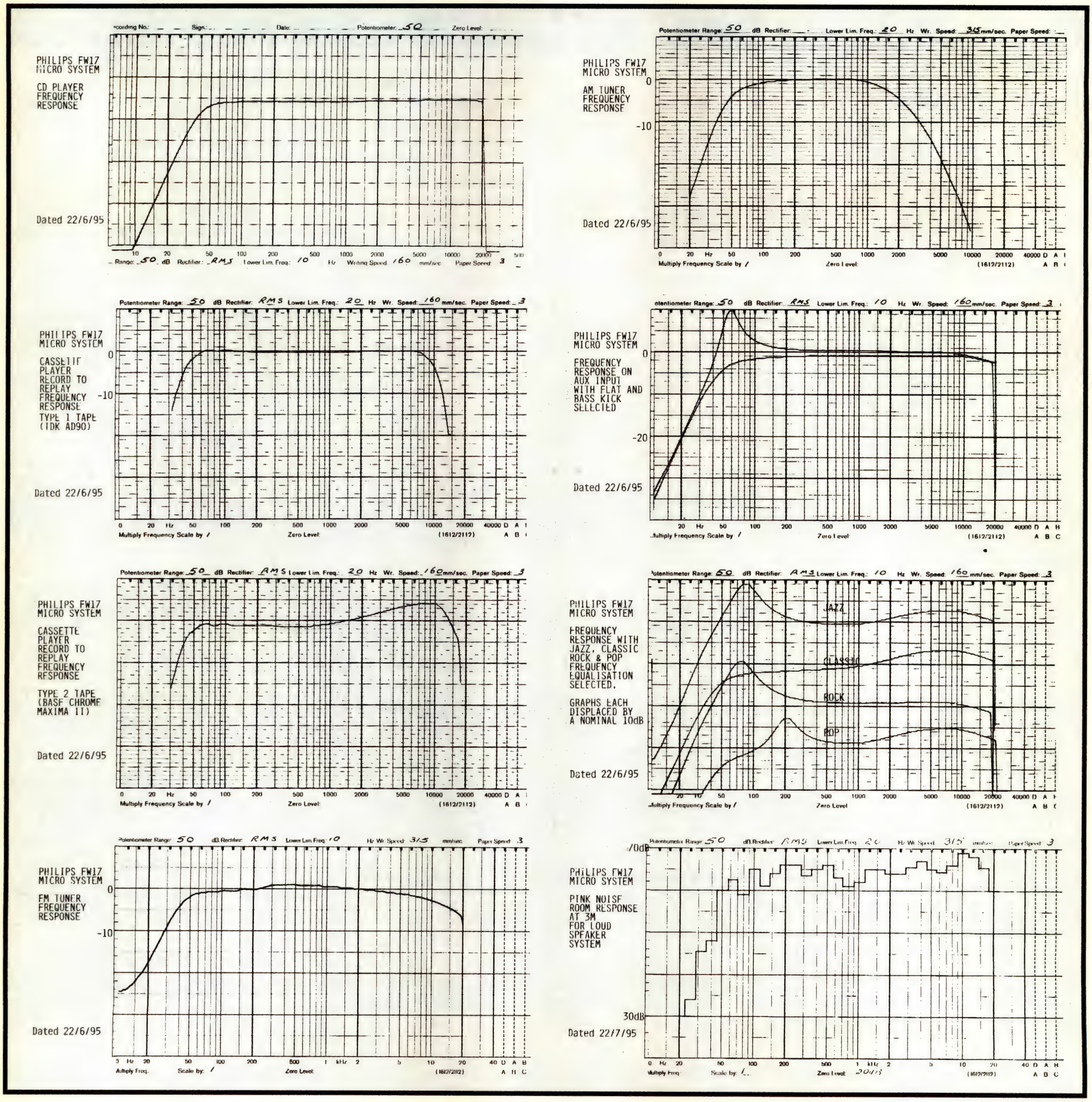
Most of us experience difficulties in identifying where the 'mini' systems begin, and the 'micro' systems end. Nobody appears to have spelled out the rules of demarcation, and the description or definition seems to be left in the manufacturer's hands.

It has been my observation that a significant proportion of mini systems have separate modules for either the CD player, cassette player, and/or the receiver section (tuner/amplifier). By contrast, the micro systems generally have all of the components, other than the speakers, integrated into a single cabinet.

The miniaturisation of the system, quite apart from simplification of cabinet construction, offers obvious advantages. The most significant of those are a reduced cost, and the ability to provide simplified interconnection and cross-feeds of signals between the subsystems and the cassette recorder. That advantage cannot be overstressed, as with few exceptions most purchasers now seek a 'user-friendly' design. With few exceptions, those designs convert what was previously a complex recording task, into the most simple of tasks which generally involves pushing either one or at the most, two buttons.

I questioned the sales personnel in a number of large department stores in Sydney. Their observations were that a major proportion of the mini and micro systems are purchased by 'yuppies' — i.e., Young Upwardly Mobile Professionals. A significant proportion of the remaining sales of the units have been to teenagers, whose demands and/or functional needs are generally similar. Very few units are sold to more mature members of our society, who tend to purchase conventional hifi systems, which are larger and more pricey.

The feature most commonly sought by purchasers of mini, and more particularly



At top left is the plotted response of the FW17's CD player, with the record to replay response of the cassette player for Type I and Type II tapes underneath. At bottom left is the response of the FM tuner, while at top right is the response of the AM tuner. Below this is a plot showing the effect of the 'bass kick' control, while below this again are plots showing the response produced by the four different equalisation options. At bottom right is the pink noise room response.

of micro systems is the absolute size of the unit. It seems that most purchasers mention their specific demands for minimal impact on shelf or desk-top space.

When assessing the unit, most purchasers seek confirmation that the unit will be able to deliver a crisp and punchy sound with as good a bass response as possible. Surprisingly, the third and most frequently the last important attribute tends to be the purchase price.

Philips of Eindhoven gained an interest in the development of the micro system somewhat later than its Japanese competitors. By the time Philips started their mini and micro system development program, its competitors already had a sizeable proportion of the world market.

Realising the importance of the task, Philips handed the development of their new range of micro systems to a project team incorporating personnel from Philips Acoustic Laboratories and the prestigious Philips Audio Development Group. The premium product in the resulting new range of micro systems was given the code number of FW17. The development team set out to achieve the best possible quality of sound within a package which was around half the size of a normal shoe box.

Whilst each of the four different systems in Philips' new micro system range was innovative, the FW17 was obviously the most interesting. The FW17 alone offers unusually good performance, particularly when the size of the units is considered, and so we decided that this was the one to review.

Three components

The FW17 came in a deceptively large cardboard carton. On opening the box, it was obvious that most of the space in the box was taken up by polystyrene packaging, and only a small proportion was actually occupied by the system.

The system itself consists of three basic elements — the micro sized electronic package and a pair of two-way bidirectional vented loudspeaker enclosures, each of which has comparable dimensions to the electronic package.

Following its removal from the carton, I discovered that the functional controls were divided into four main areas. At the top of the unit, and extending across the curved front, are the controls for the AM/FM tuner, as well as for the integral alarm clock which uses the large well illuminated LCD display.

The clock provides all the normal functions that you would expect from a conventional alarm clock. More significantly, it provides the added advantage that you can select the radio, CD player or conventional buzzer signal, as desired. The time is displayed when the unit is in 'standby' mode, the only difference being that the rear illumination is dimmed, and a supplementary red LED is illuminated on the front panel.

Measured performance of Philips FW 17-21M
Micro System
Serial No SV029516 019686

Frequency responses	
Aux Input and Seapker Output	50Hz to 20kHz +0 -3dB
CD Player to Speaker Output	46Hz to 20kHz + 0 -3dB
Cassette Deck, Record to Replay	
Type I Tape	45Hz to 9.6kHz + 0 -3dB
Type II Tape	45Hz to 16kHz + 5 -3dB
FM Tuner	53Hz to 11kHz + 1 -3dB
AM Tuner	45Hz to 2.3kHz + 0 -6dB
Continuous Output Capability for 1% Harmonic Distortion	2 x 40 watts*
Signal to Noise Ratio of CD Player at 3 volt output	62dB Unweighted 85dB (A)

*With cooling fan operating

The FM/AM tuner can store up to 30 pre-set radio frequencies. More innovatively, the timer has been designed with a supplementary function which allows you to automatically switch on the news at pre-set times each day. A conventional 6.5mm stereo headphone socket is also provided on the top of the cabinet to satisfy that requirement.

With the available power of modern microprocessors, and the ability to develop dedicated designs of LCD displays, the designers have chosen to provide comprehensive textual and symbolic information on the LCD display. Thus by way of example, when the CD player is selected, the words OPEN or CLOSE are conveniently displayed. When the cassette deck's PLAY function is selected, and no tape has been installed, the text 'NO TAPE' will appear on the display.

Similarly when the cassette deck starts playing, the words FRONT or BACK are displayed (in slightly smaller letters), to inform you which side of the tape is actually being played. A number of other special purpose symbols have been adopted to inform you on the operational functions of the micro system, the most significant of which advise on the replay frequency equalisation characteristics.

The SOUND button on the front of the main module, or the similarly labelled button of the very convenient remote control, provides a means of selecting five different primary replay frequency response characteristics. These include, jazz, classic, rock, pop and flat. When any one of these options is selected, the corresponding text is briefly displayed before changing to a much smaller dedicated symbol.

To supplement the five basic frequency contours, and obviously to satisfy the requirements of the younger generation, a further option in the form of an illuminated 'BASS KICK' switch has been incorporated. This contour provides a 10dB boost in the frequency response at 60Hz, which extends the low frequency response — but regrettably at the expense of a significantly increased level of distortion at high output levels.

The auto-reverse cassette deck is exceptionally convenient, as it avoids virtually all of the standard problems which most of us have experienced with conventional hifi cassette decks, in that it provides auto-reverse for record as well as playback.

The cassette deck provides other more endearing features. Firstly it automatically adjusts the equalisation and bias settings to suit other type I or type II tapes. (It makes no formal allowance for type IV metal tapes.) Secondly, it offers a good, but not outstanding frequency response characteristic when recording or replaying type I tapes. The frequency response is not quite as good when recording or replaying type II tapes.

Thirdly, and potentially most significantly, the micro system incorporates a RECORD/PREPARE button, and a separate CD SYNCHRO button. When used in correct sequence, these buttons firstly provide the means of preparing the cassette to accept the signals from the CD player. Secondly, by pressing the CD SYNCHRO button, the REPLAY/RECORD sequence of the two systems is automatically synchronised.

As I soon discovered, this convenient and sensible facility really simplifies the production of your own tapes — albeit with a quality which is not quite up to the same standard as the tapes that I infrequently produce with my Nakamichi Dragon cassette deck. When swapping from side-to-side, the REV MODE button again simplifies a change of direction of the tape either during recording or for playback.

The CD player has a small conventional slide-out tray, which may be activated by means of the button at the right hand end of the tray. The tray may be closed by pressing the same button, or alternatively by pressing the PLAY/PAUSE button at the front of the deck or on the remote control.

Other conventional CD controls of PLAY/PAUSE/STOP/PREVIEW LAST, or PREVIEW NEXT TRACK are also provided on the face of the micro system. The remote control provides an added facility for RAPID FORWARD or RAPID REVERSE scanning of the disc, to audibly monitor and cue it to a preferred position.

The cassette deck is supplemented by a DOLBY B noise reduction switch, and the CD player is supplemented by a PROGRAM switch which allows you to program the order of playback of the tracks on the CD, review the program, and to review the recording time for editing purposes.

The rear of the cassette deck has four colour-coded spring loaded terminals for connecting the pair of speakers provided (either immediately adjacent to, or more sensibly, repositioned to achieve optimum spatial separation). The rear of the unit also incorporates a pair of auxiliary input coaxial sockets to provide for the possibility of stereo inputs from a TV set or a VCR, should this be required.

Although the pair of speakers provided may not be described as 'micro', they do incorporate a 125mm diameter woofer and a 50mm diameter tweeter. The combined plastic and particle board vented cabinets have venting ports at both the front and rear, which is neither conventional, nor I suggest necessarily desirable. Cabinets as small as these suffer significant problems in developing useful outputs at frequencies below 100Hz, without running the risk of excessive speaker excursion.

The item of equipment on the back panel which really caught my eye was the small axial fan, which provides enhanced cooling of the power output stage when operating at continuous maximum output, or under adverse thermal conditions. The fan operates infrequently, and when it does, is not audible at a distance of 2-3m from the face of the unit.

Objective testing

I decided to evaluate and record the frequency response characteristics of each section of the FW17 micro system. As I half expected, the frequency response of the AM tuner is very limited, extending from 45Hz to 2.3kHz at the -6dB points. The response is smooth and adequate for listening to the news, but not really suitable for listening to serious music.

By contrast, the FM tuner offers a much more appropriate and acceptable bandwidth. Its frequency response extends from 36Hz to 16kHz at the -6dB points. The FM tuner's response is not quite as flat as I might have expected, but when viewed in the context of the size of the system, it is still more than good enough.

The cassette deck provides a particularly smooth record to replay response on type I tapes, and the -3dB bandwidth is again 46Hz to 9.8kHz at 0dB, and somewhat better at lower recording levels. When tested with type II tape, the frequency response is both wider, and also exhibits a rising response which peaks up by +5dB between 7kHz and 10kHz. That rising response is just audible, but not audibly disturbing. As you might expect, the CD player provides a particularly smooth response, being within + 0.5dB, from 50Hz to 20kHz, and displays no other obvious technical performance anomalies.

For good measure I also evaluated the input response from the auxiliary input to the output terminals, firstly with the flat response, and secondly when the BASS KICK response was super-imposed. It would appear that the BASS KICK response may well provide a frequency contour that some young people may prefer. Regrettably, as I discovered, it is all too frequently supplemented by a readily audible increase in the level of low frequency harmonic distortion.

I also recorded the individual frequency responses of the JAZZ, CLASSIC, ROCK and POP sound contours. Those graphs have each been displaced by 10dB to avoid confusion as to what they achieve.

The last set of responses that I measured was the pink noise room response characteristics of the FW17 system in my listening room. Although the pink noise room response was not flat, it was much smoother than I would have expected from such small speaker enclosures. During this test, I discovered that the speaker's peak output was limited to approximately 92dB(A) at 2m.

About audio power ratings

Philips describes the FW17 Micro System as having an audio power output of 600 watts PMPO, where 'PMPO' stands for *peak music power output*. Although this rating system is nowadays used by many manufacturers of consumer electronics equipment, we prefer to use the traditional *continuous effective power output* rating in our testing and evaluation of audio performance, as we believe it has greater validity. In cases where the power output under dynamic conditions is significantly greater than the continuous output, we also apply the IHF dynamic power rating.

Listening tests

Although I had the FW17 micro system for two months, more than three weeks was spent out of Sydney. As a result, most of my listening and auditioning of the system took place in the last two weeks following my return.

I soon discovered that when playing classical music, as typified by Isaac Stern and Eugene Ormandy conducting the Philadelphia Orchestra Tchaikovsky's 'Concerto for Violin and Orchestra in D Major, Op. 35' and Sibelius' 'Concerto for Violin and Orchestra in D Minor, op. 47' (Sony Classical SMK 66 829), the results are more than satisfactory considering the size of the system. I was not aware of any significant droop in response at the low frequency end of the system. At the same time, I could readily detect an accentuated brightness in the top end response.

I tried another new CD featuring Yo-Yo Ma in 'The New York Album' (Sony Classical SK 57961). This disc incorporates 'Concertos for Cello and Orchestra' by Stephen Albert, as well as 'Concerto for Viola and Orchestra' by Bela Bartok. Albert's vibrant music (as interpreted by Yo-Yo Ma) provided the opportunity to assess the broader range of acoustical characteristics of the FW17 micro system.

Surprisingly, the overall impression was better than I would have expected from such a small system. It was obvious that the loudspeakers had been designed and constructed to conform to a relatively tight budget. Even the Bartok Concerto projected exceptionally well, and again better than I would have expected.

When driven by its CD player, then, the performance of the FW17 system is particularly good, and provides a performance which is better than I would have anticipated.

I then played a new pre-recorded compact cassette 'Spirit of Spain' with Slava Grigoryan playing selected pieces from Albeniz, Mudarra, de Falla, Villa-Lobos and others (Sony Masterworks CSMT 68351). Although the playing and both the rendition of the music is particularly good, I was able to readily identify a loss of extended bandwidth at the top end of the audible spectrum, although in all other respects the replay performance was good. I repeated the exercise recording from a CD to a type I tape, and was immediately impressed by the ergonomic simplicity of the system. ON FM radio, particularly with an external aerial, the performance is good to fair. When used with the short length FM wire antenna provided, there is an obvious drop in sensitivity, as well as a detectable change in sound quality.

I have already commented about the AM tuner, which is really no better and certainly not much worse than the tuners you will find in much more expensive hifi systems.

Summary

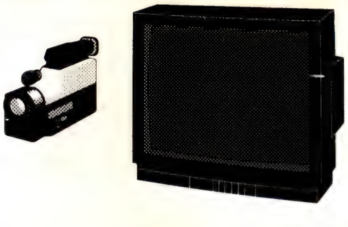
Viewed in the light of its physical, electrical and performance characteristics, I consider that the Philips FW17 system is positively cute.

No, it is not a true high fidelity system, nor should you expect it to be. What it does provide is a powerful, functional and convenient musical and entertainment system in a micro sized package, which has to be admired. This system may not provide perfection, but it makes up for that obvious deficiency with its unquestioned panache.

The Philips FW17 'Monster Micro' system has a height of 228mm, a depth of 285mm and a width of 160mm (510mm with flanking speakers). The overall weight is 6kg without speakers, and 11kg including the speakers. It carries an RRP of $799.

You should find the FW17 at most consumer electronics stores. If necessary further information is available from Philips Consumer Products, on (02) 742 8397. ❖

What's New in VIDEO and AUDIO



'Open-top CD radio cassette

Two CD Radio Cassette models featuring a motorised 'Open-Top' panel have recently been launched by Panasonic. The 'Open-Top' panel of the new RX-DT07 and RX-DS05 has a large, easy to read LCD display and keys for all major functions. When not required, it simply folds down.

Both models also have a motorised CD tray with an illuminated window. Through the window the user sees rainbow patterns reflected from the CD as it spins around. The illuminated window also assists in operating the units in the dark.

The RS-DT07 and RX-DS05 are claimed to deliver clear, pure sound due to the completely independent left and right speaker enclosures. They both feature an electronically preset equaliser which has four preset equaliser patterns — XBS, Clear, Soft and Vocal. Additionally, the RS-DT07 also has a surround sound function.

The new models also have a helpful feature known as 'Easy Auto CD Recording' which assists the user when recording from CD to tape. This function calculates and displays the length of tape necessary for recording automatically. If the last song on the first side is cut off midway, the song will be recorded in its entirety from the beginning of the second side.

The recommended retail price of the RX-DT07 is $829 and the RX-DS05 is $649.

For further information contact Panasonic's Customer Care Centre on 132 600.

Sony VCR offers no hassle playback

Nearly everyone has planned to spend an evening watching a favourite movie from the video store or an old home video, only to find themselves constantly adjusting the tracking on the VCR, trying to get a better picture. Knowing just how frustrating this can be, Sony has released the SLV-X822 featuring the new APCII (Adaptive Picture Control), which enhances picture playback quality and guarantees maximum performance from any video tape. APCII also automatically adjusts the recording current in response to the head condition, virtually doubling the working life of the video heads and making images up to 40% clearer.

Speakers for ceiling mounting

A new pair of 200mm hifi extension speaker drivers suitable for mounting in ceilings and walls have been released by Altronic Distributors. The new drivers employ carbon polypropylene cones with a concave foam edge roll surround, and offer a choice of either a coaxial tweeter or triaxial tweeter/midrange assembly, for excellent overall performance.

Both drivers are rated at 50W RMS, and mate neatly with the existing Altronics C-0805 low profile white ceiling grille. They are therefore very suitable for distributing hifi sound in dining rooms, bedrooms etc.

The coaxial model (C-2005) has an RRP of $59.95, while the triaxial model (C-2007) has an RRP of $69.95. The matching C-0805 grilles have an RRP of $4.95 each.

Further details are available from Altronic Distributors, of 174 Roe Street, Perth 6000; phone 1 800 999 007, or (09) 328 2199.

Video monitor with switcher

A new 12-inch multi-function combination monitor-switcher offers everything but the cameras for a multi-channel video surveillance system.

The MS-12 combines all of the following in a single compact unit: 12" 850 TVL monitor, four channel sequential switcher, two-way audio, sensor inputs, audible alarm with camera tracking function, camera power supply, VCR audio video inputs and outputs. Front panel controls include VCR record/playback, contrast, brightness, volume, camera select 1-4, duration, talk/listen and automatic sequential switching on/off.

Bypass of unused camera inputs is automatic. The 12 volt DC power supply has the capacity to power four CCD cameras and PIR sensors. Dimensions are a compact 304 (W) x 282 (H) x 308mm (D), with a total weight of only 10kg.

Also available for no fuss installations are 20 metre 5mm diameter multi-core camera cables, with six pin modular plugs and couplers.

For further information contact Allthing's Sales and Services, PO Box 25, Northlands 6021; phone (09) 349 9413.

The SLV-X822 is the latest in Sony's highly successful Viewtopia range and combines ease of use with advanced features, improving the overall viewing experience. It also features the G-code system which allows the user to simply program the VCR by inputting the program number published in various newspaper and magazine television guides.

NTSC recording and playback capabilities allow the viewer to watch videos from the US and other NTSC countries, even if they own a PAL only television. The Sony Viewtopia SLV-X822 has a suggested retail price of $1049.

CD changer has six disc carousel

The new Onkyo DX-C311 six disc carousel CD changer offers the convenience of extended continuous play of up to six discs, with the ability to add, remove or replace up to three discs without interrupting playback.

The DX-C311 features a centre mounted display and a new vibration reducing six disc CD tray. The DC-C311 also offers Onkyo's FPCS (Fine Pulse Conversion System), a digital signal processing system that is claimed to give CDs the same 'warmth and musicality' which purists often regard as being possible only in analog systems. Based on technology borrowed from the latest advances in computer graphics, FPCS reduces ringing during filter interpolation and makes a more accurate computation of any missing signal data.

Other features of the DX-C311 include: single bit converters and an eight times oversampling digital filter; seven repeat modes — entire disc, all discs, A-B, memory, single track, random, random memory; three mode time display; 40-track memory; forward/reverse track skip; and a peak search function. It is supplied complete with a 30-key, RI compatible infrared remote control and has an RRP of $799.

For further information circle 181 on the reader service coupon or contact Amber Technology, 5 Skyline Place, Frenchs Forest 2086; phone (02) 975 1211.

Kenwood CD receiver for cars

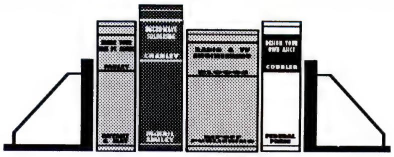
Kenwood's latest CD receiver/changer line-up includes four models: the KDC-7004, the KDC-6004, the KCD-5004 and the KCD-4004.

With security a main design feature, Kenwood have updated their proprietary Theft Deterrent Faceplate (TDF) technology in all models except the KDC-4004. The detachable faceplate allows the driver to quickly disable the unit by simply removing the faceplate cover when leaving the vehicle unattended. The detachable faceplate then fits comfortably into a short pocket or handbag, and simply snaps back into place. This is an effective deterrent against potential theft.

All models incorporate Kenwood's Dynamic Resolution Intensive Vector Enhancement (DRIVE) technology, which is claimed to extract even the smallest music signals from unwanted digital artefacts, and output them with 20-bit resolution. By combining this DRIVE technology with eight times oversampling, plus a 20-bit digital filter Kenwood says it is able to achieve high quality music with 20-bit resolution at all signal levels.

The flagship KDC-7004 is a combined CD player/receiver with the facility to address a multi-player CD or MD unit. It offers four 25W channels, plus stereo outputs to drive higher powered amplifiers if required. Separate bass and treble controls allow individual tonal control, and a loudness control boosts bass and treble notes for when listening to music at lower levels. ❖

NEW BOOKS



Multimedia technology

INTERACTIVE TELEVISION: A Comprehensive Guide for Multimedia Technologists, by Winston W. Hodge. Published by McGraw-Hill, 1995. Hard cover, 243 x 193mm, 209 pages. ISBN 0-07-029151-9. RRP $79.95.

The 'interactive digital multimedia' era is galloping towards us, and many of us are going to have to acquire a reasonable handle on the rapidly converging technology behind it — technology that even for many electronics people involves a lot of relatively unfamiliar concepts.

The author of this book is a highly respected US authority in this area, who began back in the early 1960s with satellite image signal processing and compression, flight simulators and image databasing. He was involved in the first development of 'video on demand' (VOD) systems for hotels, and has also played a key role in the development of ATM switchers and set-top boxes. In short, he's been a pioneer in the field.

In the book he certainly covers the main subject areas you'd expect to find: the converging of computers, imaging and communications; VOD architecture and systems; CATV and telco network evolution, including fibre-optic distribution; image compression technology; storage systems and video servers; switching and routing; set-top box function and design; and so on. However as you might suspect from its modest size, this enormous subject is covered in a very concise fashion.

It's all very businesslike, and there's undoubtedly a lot of valuable information presented; but not a great deal of introductory and linking material to help those who aren't already steeped in the jargon and the concepts behind it.

To my mind, then, it's more of a reference for those already *in* the field, than a primer for those wanting to enter it.

The review copy came from McGraw-Hill Book Company Australia, of 4 Barcoo Street, Roseville 2069. (J.R.)

Computer interfacing

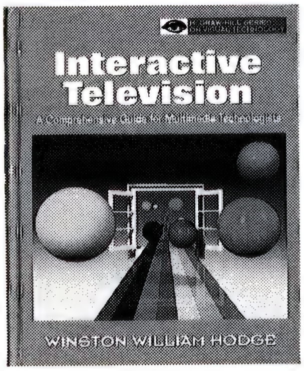
BUILD YOUR OWN LOW COST DATA ACQUISITION & DISPLAY DEVICES, by Jeffrey Hirst Johnson. Published by Tab Books, 1994. Hard cover, 243 x 193mm, 305 pages. ISBN 0-8306-4349-4. RRP $51.95.

This book is mainly aimed at anyone wanting to use a PC's I/O ports, and is very practical, being mainly based on the author's experiences. It starts by covering PC architecture, with a detailed look at the interrupt mechanisms and a brief introduction to the 80x86 microprocessor. The key principles of serial and parallel data transmission are also described, based mainly on the RS-232 and Centronics standards.

Things become more practical from Chapter 4 onwards, where the author explains how to use and program the standard serial port. Chapter 5 does the same for the parallel port. Sample Borland Turbo Pascal program listings are included for both ports. Chapter 6 deals with hardware in the form of simple building blocks that can be used to construct data acquisition circuits. Complete systems are then described in the last chapter.

The book assumes little knowledge of electronics, but you'll need to be familiar with Pascal to get much from the programming examples. Some listings are in C and C++, and there are a few in assembly language. The author claims Pascal is the easiest language to understand, but I wonder why he didn't include a few examples in BASIC. After all, every PC comes with it, and most people have a passing knowledge of the language.

The writing style is friendly and easy to read. The review copy came from McGraw-Hill Book Company Aust., of PO Box 239, Roseville 2069. (P.P.)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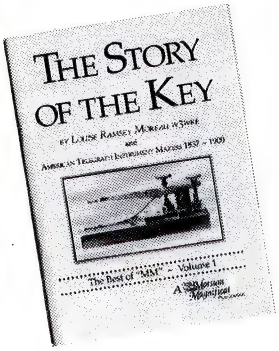
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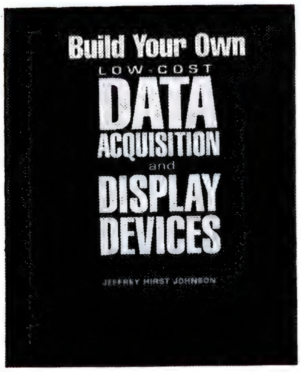

Telegraph keys

THE STORY OF THE KEY, by Louise Ramsey Moreau W3WRE. Published by G.C. Arnold Partners, 1995. Soft cover, 210 x 146mm, 60 pages plus cover. ISBN 1-898805-07-5. Price £4.75 direct from the publisher.

In addition to publishing the well known vintage radio bimonthly *Radio Bygones*, independent British publisher Geoff Arnold and his partner also produce the English language version of *Morsum Magnificat*, which is very popular with Morse code enthusiasts and 'true believers' around the world. This is the first of a planned series of special publications from the *MM archives.*

The Story of the Key was originally written as a series of articles in *MM* by the late Louise Moreau, a US historian of telegraphy and collector of telegraph keys, who died in April last year. Now integrated into a single narrative, it describes the development of the key from the Alfred Vail 'Correspondent' model used by Samuel Morse himself in 1844, right up to the elaborate models used in their heyday.

There are over 75 indexed photographs, and also a listing of *American Telegraph Instrument Makers from 1837 to 1900*, originally published in the US magazine *Dots & Dashes*.

If you have even a passing interest in Morse keys and the era in which they played such a crucial role, it's a fascinating little volume.

The review copy came direct from the publisher, who can supply direct by airmail for the price given. Orders should be addressed to G.G. Arnold Partners, 9 Wetherby Close, Broadstone, Dorset BH18 8JB, England; or fax +44 1202 658474. Mastercard, Visa, Access and Eurocard orders are accepted. (J.R.) ❖

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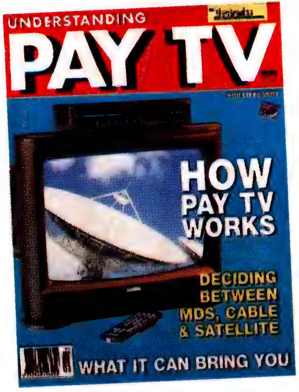


Retailer discovers a nasty techno-scam:

WARNING: SOME CACHE RAMS AREN'T!

Readers who have recently purchased 'bargain price' 486-based PC motherboards of Taiwan manufacture, fitted with on-board secondary cache RAMs, are advised to check them very carefully. A prominent local retailer has discovered that one batch of low cost motherboards they ordered, in good faith, were actually fitted with 'dummy' or 'dud' cache RAM chips — but had been carefully modified so that this would not be apparent...

by JIM ROWE

This is a difficult story to write, for two reasons. One is that it's uncovering what appears to be a very nasty scam — where overseas suppliers seem to be supplying goods which are not as ordered, but are at the same time 'doctored' to look as if they are. It's possible that quite a few people may have purchased the goods concerned, but still don't realise that they've been duped. Writing a story which brings such unhappy tidings is never a pleasant task.

In this case the scam is also a very technical one, involving a functional subsystem deep in the bowels of personal computer motherboards. This makes it both difficult to explain, and tricky for the people who've bought these motherboards to even tell whether or not they've been duped.

Since criminal activity is involved and legal action could therefore eventuate, I also have to be especially careful in terms of what I write — making sure I don't allege or accidentally imply criminal activity by innocent people. Yet at the same time having learned of the scam, I have an obligation to pass on this information, in order to allow any possible victims to be warned and take the appropriate steps.

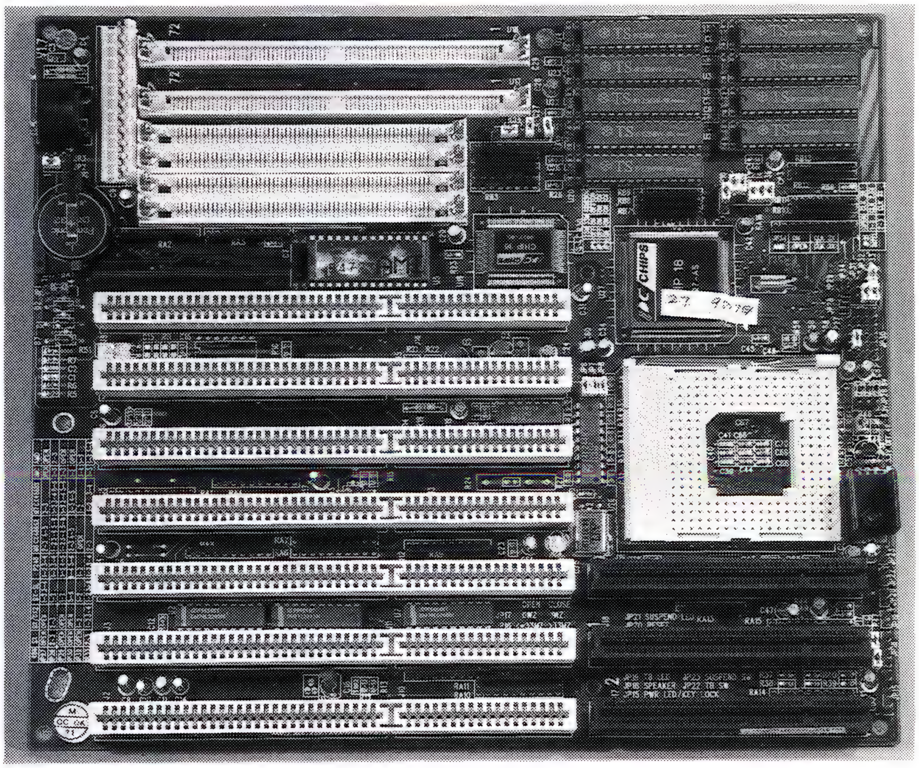
So bear with me, please, while I try to explain what it's all about.

A couple of weeks ago, electronics and computer retailer Rod Irving (founder and MD of the Rod Irving Electronics chain) rang me with the news that his technical people had uncovered what seemed to be a scam, in a trial batch of Taiwan-made '486-based PC motherboards that had been offered by a local distributor.

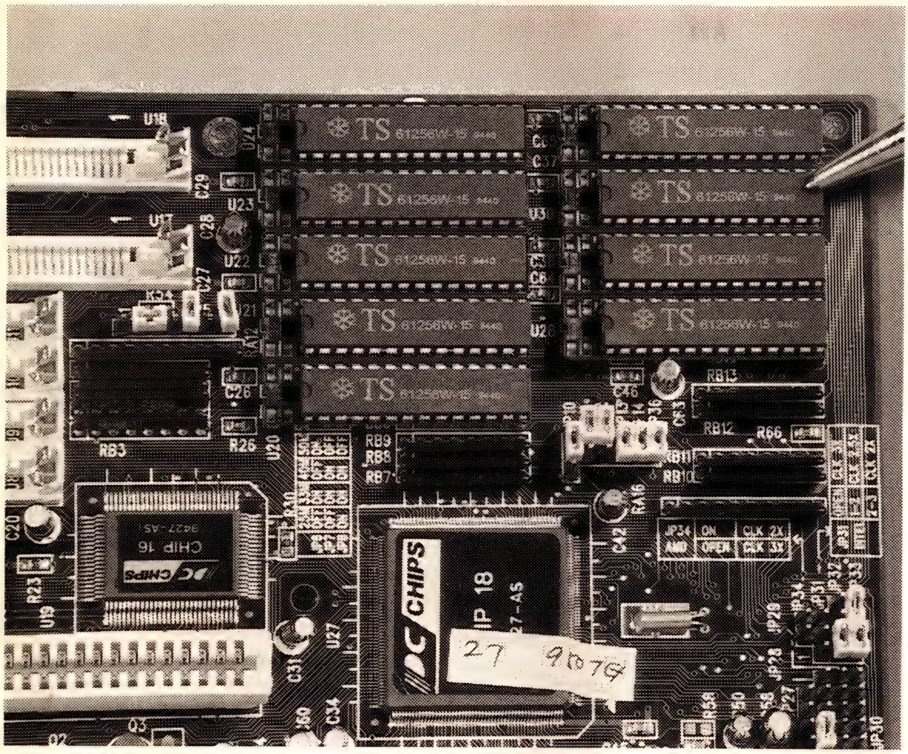
The boards had been ordered with 256KB of L2 cache RAM chips fitted, because the distributor's quoted price for this configuration had been agreeably lower (around $20 cheaper at the wholesale level) than that charged by other suppliers.

By the way if you don't really know what cache RAM chips are, don't worry about it for now. We'll try to explain later. At present, just take our word for it that they play an important role in the 'innards' of a modern high-speed PC, to achieve full performance. Because they have to be very fast SRAM (static RAM), they're also fairly expensive — a set of them to provide 256KB of L2 cache for the type of 33MHz local bus motherboard we're talking about would typically sell separately for about $160 retail.

Now Rod Irving and his team at RIE are very experienced buyers in the fiercely competitive world of PC components, and as well as being pleasantly surprised that the supplier concerned had been able to offer the motherboards for $20 less than they'd previously been paying, they



Shown here is one of the 486/33MHz motherboards delivered to Rod Irving Electronics with 256KB of cache RAM fitted. Although it has nine chips plugged into the cache RAM sockets (top right), there's in fact no cache RAM present!



In this close up view of a suspect motherboard, the pen is pointing to one of the 'cache RAM chips that aren't'. Presumably, they're either faulty cache RAM chips or dummy packages made to look like real ones.

were a teeny bit suspicious. There was always the risk that the boards might be dubious in some way; so when the trial shipment arrived RIE's chief technician Gary Kicic and his team gave them a particularly thorough Q&A inspection.

While other suppliers might be content with a quick visual inspection of motherboards, to check that everything seems to be in order, Mr Kicic and his technicians have found from past experience that it's always a good idea to power up some sample motherboards with a CPU, a set of main memory SIMM modules and some representative plug-in cards, to give them a full functional check. But on this occasion they went even further, and *really* gave the boards a complete workout using a whole range of diagnostic programs.

Why use a *range* of these programs? Simply because each of the commonly available diagnostic programs tends to have its strengths and weaknesses. Some also have known 'blind spots', possibly because their designers thought some aspects of the hardware functioning either didn't need to be tested, or were too hard to test.

Although the boards did indeed have what appeared to be a 256KB set of cache RAM chips fitted in the appropriate sockets, and the motherboard jumper links were set to suit 256KB of cache memory, and the configuration data in the 'BIOS setup' CMOS memory on the boards confirmed that there was 256KB of L2 cache RAM present, the actual testing came up with some worrying discrepancies:

The speed performance figures they obtained were virtually identical to those for a 486 CPU working at 33MHz, but in a motherboard not even fitted with L2 cache chips. In other words, the on-board cache chips didn't seem to be working...

Some of the diagnostic programs that are more 'enquiring' in the area of cache RAM (like AMIDiag) reported that the system had no cache RAM present.

Trying to temporarily disable the on-board L2 cache, by toggling the appropriate line in the BIOS setup data, wouldn't work. In fact the configuration program wouldn't let you change the cache RAM setting at all; it stayed fixed at 'ENABLED'.

With their suspicions by now really aroused, they tried a few further tests.

First, they tried removing one of the supposed cache RAM chips, to see what effect this would have. If the cache RAMs were indeed functional, this should have produced an error message from the POST (Power-On Self Test) routine immediately after power-up. But instead there was no message; the system functioned as if all was well. In fact the same thing happened when they removed ALL of the supposed cache RAM chips and their associated tag RAM chip — showing that the system couldn't even tell when they weren't physically there...

This suggested that the motherboard BIOS might have been subtly modified, so that it simply ignored the cache RAM sockets and disabled the on-board L2 cache memory controller. This would have forced the CPU to function with its own on-chip L1 cache alone, in the same way that it would on a motherboard not fitted with cache chips.

To test out this theory, they tried removing the existing BIOS ROM and replacing it with a known-good BIOS ROM from an otherwise identical and working motherboard with 256KB of authentic — and functional — cache RAM chips. Then they applied the power, and the new BIOS immediately reported that there wasn't any cache RAM fitted. It continued to give exactly the same message when the original 'tag and cache RAM' chips were replaced, showing that these were indeed non-functional.

Similarly when the suspect original BIOS ROM was fitted temporarily to a known good motherboard with functional cache RAM chips, suddenly *that* board's cache RAM didn't seem to be operating any more — and diagnostic programs like AMIDiag reported that no cache RAM was present, even though it was!

Scam indicated

Taken together, there's really only only logical inference you can draw from this evidence. It all points to a scam, whereby faulty or non-functional chips (or perhaps even dummy chips) are being placed in the motherboard sockets to give the *appearance* that cache RAM is fitted. Then, to prevent this substitution from causing any obvious disturbance to the CPU's operation, the motherboards are apparently fitted with a slightly modified BIOS ROM which disables the on-board L2 cache controller, so that the system simply forgets about L2 caching and the CPU is forced to use only its own internal L1 cache.

So the computer in which the motherboard is fitted runs without obvious problems, but as a system with 'zero L2 cache'. And without the benefit of Level 2 memory caching, it simply cannot achieve the full potential of a 486 processor at the clock speed concerned.

What's the motive? Clearly, it's greed. Motherboards with no functional L2 cache RAM are being sold as if they *do* have cache RAM chips fitted, and customers are therefore being duped into paying something like $160 extra to get the benefit of L2 cacheing, when it's not really there at all.

Since the motherboards are only being fitted with dud or dummy cache RAM chips, worth almost nothing, the manufacturer can no doubt afford to offer the boards to the local distributor at a significantly lower price than they'd have to charge for a board with *real* cache RAMs fitted — while still making a healthy extra margin. And the distributor (who may or may not be aware of the substitution) can presumably pass on the saving, explaining why the boards can be offered to the retailer at a noticeably lower price.

How widely sold?

An obvious question here is how many of these 'dummy cache RAM' boards might have been sold already in Australia, to unsuspecting customers?

I gather from the people at RIE that *they* suspect quite a significant number of the boards have already been sold by the local distributor, to retailers in both Sydney and Melbourne.

So quite a few people may well have purchased these boards as part of 'bargain priced' 486-based computers, and until now haven't realised that their machines don't really contain the cache RAM they were told was included. And because the machines work — albeit somewhat slower than they should, particularly with some types of software — they might never have become aware that they'd been duped.

Needless to say once RIE had confirmed that the trial batch of motherboards they received had the 'dummy cache RAMs', they immediately informed the supplier that they wouldn't be buying any more of *that* type. The boards concerned were sold as 'zero cache RAM' boards, at a suitably lower price, and the buyers informed that they probably wouldn't be able to upgrade them by fitting authentic cache RAMs.

How to check

Obviously, anyone who suspects that their 486 machine might be fitted with one of the 'dummy cache RAM' motherboards will want to know how to check it out.

It's important to emphasis here that the scam we're talking about involves what

Cache Memory and how it works

As cache memory has only appeared quite recently in personal computers, many readers may be unfamiliar with it. If so, we hope you find this short explanation helpful. It has been generously provided by Gary Kicic, chief technician at Rod Irving Electronics:

High performance microprocessors have an ever-increasing need for fast access to data. Combine this performance need with a more slowly-developing DRAM (dynamic RAM) technology, and a problem occurs. Whenever the processor needs to access memory, wait states must be inserted to allow the slower DRAM to catch up. Since the microprocessor accesses memory far more than any other system element, processor performance suffers severe degradation by the insertion of these wait states.

The most common method used today to overcome this problem is to place a small block of high speed memory between the processor and its main memory storage area. Known as *cache memory*, this memory consists of static RAM with typically access speeds operating at 15ns (nanoseconds). The cache memory is managed by a cache controller, the function of which is to attempt to keep the cache filled with instructions or data that the processor is most likely to need next.

If the information the processor requires next *is* held within the cache, it can be retrieved without wait state insertions. This is the fastest possible memory operation, and is known as a cache 'hit'. If however the data is *not* held in the cache area then the processor has to retrieve the information from the normal DRAM area with the inclusion of wait states. This is said to be a cache 'miss'.

Cache memory can be internal or external to any particular processor. An *internal* cache, also known as primary or L1 (Level 1) cache, is one built inside the processor chip itself. This is the fastest type, but static RAM takes a lot of chip area, and generally only a small amount of L1 cache can be provided. The 486 range of processor chips have 8KB of L1 cache, while Pentium chips have 16KB.

As the limited L1 cache is not really enough to achieve the full performance benefit of caching, further *secondary* or L2 (Level 2) cache memory can be used. This requires a set of high speed SRAM (static RAM) chips on the motherboard, together with an external cache controller.

The i386 series of processors had no L1 facility, but could use L2 cache ranging from 64KB on earlier motherboards to 128KB on more recent units. The majority of current 486 and Pentium motherboards cater for 256KB of L2 cache as standard, with a capacity to expand to 512KB or even 1MB on some of the latest boards.

The L1 cache used in the i486 series of processors contains a mixture of microprocessor instructions and data, and this involves some compromises. In the Pentium processors the L1 cache is divided in two, with one half used for instructions and the other half for data — yielding a further performance gain.

But how does the microprocessor determine whether the information required is available in cache memory or not? Current systems use one of three methods for cache management:

DIRECT MAPPED CACHE: This method divides the cache RAM into small blocks. Each block is called a line, and each line is identified by an index bit. The main memory area is then divided into blocks the size of the cache, and the lines in the cache correspond to the location within a memory block. Each line can be drawn from a different memory block, but only from a location corresponding to the location in the cache. A 'tag' bit is used to identify which block the line is drawn from. Determining whether a given byte is stored in a direct mapped cache is achieved by checking the tag bit for a given index; this is the function of the cache controller.

FULL ASSOCIATIVE CACHE: Here each line of the cache can be associated with any part of main memory. Lines of bytes from any location in main memory can be placed side by side in cache. The cache controller must then check the addresses of every line in the cache to determine whether the memory request was a hit or miss. This was seen as a major shortcoming, and a compromise was reached between direct mapped and full associative caching.

SET ASSOCIATIVE CACHE: This method divides total cache memory into a number of smaller direct mapped units. The 'four-way set associative cache' is the most commonly used method. It is possible to increase the set size, however the law of diminishing returns quickly rears its head as the cache controller has to spend more time determining whether the required information is in cache or not. Most motherboard manufacturers have settled on the four-way set associative cache as the best compromise on performance, complexity and cost.

Cache memory also has different ways of *writing* information to memory. In general, cache was not used to speed up write operations; when a write operation was required the data would be pushed through the cache immediately — writing to cache and main memory at the same time, with normal wait state delays to main memory. This method is the safest approach, as it guarantees that both cache and main memory always contain the same information. It is known as *write-through* cache.

A newer innovation, or dare I say it a faster method, has recently been introduced — known as *write-back* cache. Here information is written to cache memory, and when the cache controller is ready it is then written to main memory.

The danger here is that there are times when cache memory and main memory have different contents assigned to the same locations. The cache controller must continually check the changes made in main memory and ensure that the contents of the cache agree with any alteration. This 'sniffing' or 'snooping' of cache and main memory makes the design of the cache controller more complex, and therefore more expensive to implement. However for the utmost in performance, write-back cache is the best solution.

Cache memory and techniques can be a difficult subject to grasp. An excellent reference that covers the i386/486 architectures connected to the ISA bus can be found in the book *ISA System Architecture*, by Tom Shanley and Don Anderson (Mindshare Press; ISBN 1-881609-05-7).

appear to be motherboard PCBs that are completely normal in the *physical* sense, so you can't tell anything by examining them visually. Those that RIE received were almost unmarked in terms of identification — but this applies to almost all of the 'clone' motherboards made in Asia, so it's probably not significant.

The RIE boards actually have 'P&Q' etched into the copper underneath, and the accompanying User's Guide booklet described the motherboard as the 'Deep Green' board. However it's quite possible that you could have the identical PCB and book, with authentic cache RAMs and an entirely standard BIOS.

Nor is it really possible to use the brand label on the BIOS ROM as a clue, either. The boards that RIE received had ROMs with the AMI (American Megatrends Inc.) label, even though the User Guide was written to accompany boards fitted with an Award BIOS. But apparently this sort of BIOS brand swapping is quite common with many motherboard manufacturers; they tend to have licence agreements with a number of the BIOS vendors, and program batches of ROMs with each BIOS. If they run out of one type during a production run, it's not uncommon for them to use another BIOS to complete the order. So absolutely authentic boards can have a different brand of BIOS to that described in the User Guide.

(Incidentally, you may be wondering how we can talk about the scam involving a 'doctored' BIOS, when the BIOS on the 'dud cache' boards was still apparently licensed from a reputable BIOS vendor. That's because the manufacturer only buys a licence for the 'core' BIOS program, and then adds their own code to customise the BIOS for their motherboard(s). So it would be entirely feasible for the board manufacturer to have ROMs with licenced copies of any vendor's BIOS, but still 'doctored' to suit boards fitted with dummy or faulty cache RAMs.)

Again, it's unlikely that you'd be able to tell by simply examining the supposed cache RAM chips. Those fitted to the boards received by RIE look quite genuine, as you can see in the photo — although the 'TS' brand is one that neither we nor Gary Kicic has been able to identify. A possible clue, perhaps, but we wouldn't bet on it.

No, the sobering reality here is that the only real clues to this scam are hidden inside the 'cache RAM' chips themselves, and inside the BIOS ROM. So the only definite way to tell whether or not your computer is fitted with *real* cache RAMs is to test it electrically.

Here are our suggestions for doing this:

1. Try entering the BIOS setup configuration option, which usually involves pressing a combination of keys during the computer's boot-up sequence. You can then see the setup information stored in the computer's battery-backed CMOS memory. In one of the submenus, you'll find a line that reads something like 'EXTERNAL CACHE: Enabled'. Position the cursor on this line, and try pressing the key that is supposed to toggle this option to the 'Disabled' status. If it *will* toggle, your cache RAM is probably OK; if it won't, it may not be what it seems.
2. With the cache nominally toggled back to the 'Enabled' status again, exit from the setup routine and save the settings as directed. Then allow the computer to boot up normally. Now try running a diagnostic program like AmiDiag, which is known to be able to detect whether or not L2 cache RAM is really present. If it finds the correct amount of cache RAM, it's almost certain your machine is OK; but if it can't *find* any L2 cache, you have another confirmation that your motherboard is suspect.
3. A final check, if your system flunks on the above two tests, is to turn off the power and open up the machine. Then you have to carefully remove one of the supposed cache RAM chips from the motherboard. Unfortunately you may have to remove one or more of the disk drives, to find them; as you can see from the photo, they're often over in one corner and adjacent to the long sockets for the DRAM memory SIMM modules. The idea is to first earth yourself to the computer chassis, to discharge any static electricity you may have acquired; then carefully remove one of the chips (it probably doesn't matter which one), and place it in a piece of conductive plastic foam to prevent damage (assuming it may be a good one). Finally, temporarily refit any disk drives you've had to remove, and power up the computer again. If your motherboard is a good one, with real cache RAM chips fitted, the POST routine should immediately discover that one chip is missing and tell you that there's a problem. But if it still sails through boot-up and doesn't seem to notice anything amiss, you've now confirmed that you do have one of the 'dummy cache RAM' motherboards. Sorry!

If you end up in this unhappy position, all we can suggest is that you take it back to your computer retailer and demand either compensation, or a replacement motherboard or machine with authentic cache RAM fitted. If they've sold it to you in good faith, they should be happy to take your dud one back and claim from their wholesale supplier.

By the way, don't settle for a set of real cache RAM chips. Since these motherboards do seem to have a 'doctored' BIOS, they probably won't be able to take advantage of real cache RAMs even when these are plugged in to replace the duds. And because the motherboard manufacturer pays royalties on each BIOS chip, a retailer or distributor can't legally replace the BIOS chip. The only way they can provide you with a known-good BIOS chip is to replace the entire motherboard.

Want to know more?

Hopefully the information I've given so far will be all most people need, or will want to know, about this nasty little scam. However for those who would like to know more about what cache memory is, and the role it plays in a modern PC, please refer to the explanation given in the accompanying panel. This has been provided by Gary Kicic of RIE, who volunteered to help out because cache memory operation is quite a complex thing to explain. My thanks to Gary for his assistance, and I hope you find the explanation helpful.

If you want to do further reading in this area, Gary lists a helpful reference book. I also found some reasonably easy to read material on cache memory in the latest edition of Peter Norton's book *Inside the PC, Premier Edition* (1995). ❖

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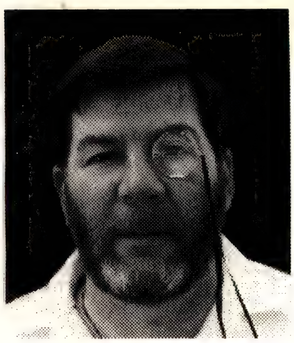
by TOM MOFFAT



Moments of memorable mischief

Ta Da! Whoop-de-doo! Razzle-dazzle! Ladies and gentlemen, boys and girls, I would like to announce that what you are looking at here represents sixty months — five years — of madness! Yes! I haven't yet been sacked from Electronics Australia. I am not yet in jail, and I still haven't taken up my reserved room in the funny farm. However all these possibilities still lurk in the shadows, as you shall see.

I had planned this month to introduce you to another of the Madhouse characters, along the lines of Flubby the Wonder Technician. Many would say this fellow would make an excellent Madhouse resident, since his claim to fame is his ability to single-handedly disarm atomic bombs. But events have overtaken him, so this gentleman will instead entertain you with his tales next month.

Events came to a head with the discovery in early March of a citizen's militia group operating in Canberra, with some members firmly entrenched within the Department of Defence. This piece of information surfaced in the wake of the Oklahoma City federal building bombing, which is being blamed on similar groups within the USA.

My own awareness of the USA groups was triggered by the chance discovery, via scanner, of a dissident radio station in the south-eastern part of the USA, which was giving militia group members a nationwide voice. These people were being branded as crackpots by the mainstream radio stations; they were being vetted and filtered out of the talkback radio programs before they could open their mouths. But WWCR radio let them air their views, no matter how radical and unpopular they may be.

A few days after my scanner hiccuped on 5065kHz and presented me with WWCR and its rather unique programming, I was in Colorado Springs researching an article on Nikola Tesla. In case you haven't seen the article yet, Tesla is credited by many people with the development of some of the world's most significant inventions, among them radio (instead of Marconi).

Tesla worked by abandoning conventional thinking and just letting his mind fly, resulting in some pretty weird solutions to common problems — such as a turbine without blades. Tesla was thus a true free-thinker, and today his work attracts other free-thinkers who contemplate such things as alternative energy sources, unconventional cancer cures, and new-age concepts such as crystals and pyramids as health aids.

I learned that the International Tesla Society has its own weekly program on the above-mentioned WWCR, where proponents of alternative thinking are encouraged to air their views. It makes very interesting listening indeed (although because of the time of transmission it's inaudible in Australia).

Now the point of all this is that no matter how silly or even abhorrent these people's views seem, they are still allowed to express them, in America at least, because that country has a right to free speech as embodied in the Constitution. Nobody can stop them saying what they want, in public or in private. But implicit in the right of free speech is the right to refuse to circulate views which you personally disagree with. So the mainstream media can legitimately refuse to broadcast ideas they see as crackpot; hence the role of stations like WWCR.

It should also be noted that alternative ideas are almost always at odds with government ideas. The militia people (who refer to themselves as patriots) believe that the government is hell-bent on removing individual freedoms. Many feel that there is collusion to abolish individual governments altogether, to be replaced by one world government, a re-born United Nations. Even much of the knowledge surrounding Tesla speaks of government confiscation and suppression of his most significant research findings.

So governments have a lot to fear, from dissidents circulating their views and stirring up even more dissidents. Perhaps they remember that the United States government came about in the first place by a citizens' militia overthrowing the rule of England.

Back to Canberra: reports of the militia group there had been running for several days, until one night ABC News carried a piece showing various toughs and skinheads at some noisy demonstration. The voice-over commentary, delivered in a rather venomous style, said that the militia group (not necessarily the people pictured) advocated freedom of speech. The reporter's words were spat out: Freedom of Speech!

So, people who believe in freedom of speech are now heaped in with Nazis and skinheads, at least in the eyes of ABC News. In the same news item, we saw people marching under the banner of the Eureka flag, and under the Nazi flag. Now this is a little worrying to me, because I am one of those people who believe that Australia should eventually throw off the English ties and go it alone. Not eject the present Queen, mind you, but when she retires, we retire too...

When the republican movement first surfaced a few years back, the Eureka flag became its symbol, and to show my support I got one of those little stickers with a Eureka flag superimposed upon a map of Australia and stuck it on the back window of my car. Now I see that same emblem displayed in the ABC News story alongside the Nazi flag. All to illustrate a hated citizens' militia.

What gives? And where does all this leave me, a poor harmless magazine writer?

- I advocate freedom of speech (particularly in the March 1995 Madhouse column), poisoning the minds of tens of thousands of readers.
- I have a Eureka flag sticker on the back of my car.
- I am a foreigner.

Am I to go to jail? Or be deported? Or both? I don't think so somehow; in this country we are still allowed to speak out. But if because of recent events, fears grow that those who speak out also shoot people and blow things up, one begins to worry.

Still on that March Moffat's Madhouse column, what we were on about there was the right to privacy as well as freedom of speech. In particular I was worried about the consequences of speaking one's mind on the Internet, which at the moment must be the world's greatest bastion of free speech. You can say anything you like on the Internet; you can even circulate instructions on how to make bombs to blow up federal buildings. And people do just that...

I was worried that governments might find it profitable to monitor what was transmitted on the Internet, so as to keep better tabs on their citizens. And I mentioned a rather snazzy encoding method which would shield one's communications on the net from prying eyes. However for this little software gem to receive official approval, governments would have to be given the decoding key so they could eavesdrop on anything.

During my travels in the USA early this year I was able to find out more about this encoding scheme. It was originally developed by researchers at the Massachusetts Institute of Technology (MIT). They were intending to publish their encoding research as a scientific paper, but the US government got wind of it and 'asked' them to cancel publication.

The US government did have some rights to this material, since it was developed with grants from the National Science Foundation and the US Navy. But the government wasn't quick enough; copies of the research paper had already gone out to places like *Scientific American* magazine.

The encoding scheme eventually ended up in a commercial package called ViaCrypt PGP (PGP refers to Pretty Good Privacy). This spawned a public domain version known simply as PGP, which quickly became available on the Internet. I understand it is now possible to download it as filename **PGP23A.ZIP** from several Internet FTP sites, among them **soda.berkley.edu** in the file area /pub/cyberpunks (what an appropriate name!).

However, be warned of reports that the US government is monitoring various sites, to establish just who is downloading PGP, on the assumption that anyone who has a need for unbreakable privacy must have sinister motives. And that justifies once again, just why PGP is necessary — to foil government snooping.

I must state here and now that I haven't downloaded PGP, because I can't really think of a use for it. I find it much more satisfying to broadcast my seditious remarks within the pages of a magazine like *Electronics Australia*, where there is a guaranteed audience. So the CIA can stay away from my door, thanks very much. (That's the Computer Institute of Australia, of course...)

Now a note of some sadness, again relating to freedom of speech. You may remember back in December 1993 Moffat's Madhouse discussed a radio preacher, Dr Gene Scott, who managed to suck in over three million dollars during one radio program. This fellow ran a couple of big shortwave transmitters, one of them on 5935kHz. He seemed to have some kind of automated system of broadcasting, wherein bright music was played, occasionally interrupted by announcements asking listeners to ring Dr Scott from anywhere in the world, reverse charges.

Callers were then expected to make donations to Dr Scott, in minimum amounts of $10,000. And, it seems, they did. From time to time Dr Scott would break in himself to acknowledge the donations and ask for more.

The Madhouse column wasnt exactly complimentary, and I fully expected to hear some unkind words from Dr Scott's money machine, or even his lawyers. But nothing has been forthcoming; maybe they didn't hear about all the publicity so far away in Australia. Or maybe they did, and realised that the article was an accurate account of the facts and we thus had no case to answer.

Anyhow, I've checked on Dr Scott's broadcasts from time to time to see what he's up to (never again hearing a three-million dollar appeal for donations incidentally). There's been lots of music and preaching, loud and clear. That is until a few days ago, when an enormous buzzing signal popped up right on his 5935kHz frequency.

This thing sounds distinctly like a jammer. It's a pity if this is the case, because as much as anyone may disagree with Dr Scott's message or money-raising techniques, he should still have the right to broadcast what he pleases without malicious interference. Nobody is forced to listen to him.

Well, there you go, more raving from the Madhouse. But at least I've got it off my chest and hopefully I've got you people out there thinking about our freedom to communicate with each other unfettered by government interference or regulations.

With the Oklahoma City tragedy as a catalyst, it is possible that freedom of expression in the USA and all over the world may be eroded forever. That would be an even bigger tragedy.

Do you think Moffat's Mahouse will survive another five years? Sometimes I worry about running dry, but it hasn't happened yet. I'm really going to try to get off my high horse and get back to some lighter things in future, I promise.

Like next month, and our atomic bomb man? Well, I guess he would have made a pretty bright flash if he'd gone off! ❖

THE WIDE WORLD OF WWV

Most people who have searched the shortwave bands for signals will be familiar with the time and frequency signals from US stations WWV and WWVH, which have been operating for many years. But where do those familiar signals come from? Recently Tom Moffat was able to visit the US National Institute of Standards and Technology, in Boulder, Colorado, and the WWV station in nearby Fort Collins. Here's what he discovered.

by TOM MOFFAT

National Institute of Standards and Technology laboratories in Boulder, Colorado, USA. The Flatiron Mountains are in the background and are said to be infested with mountain lions.

"This is the National Bureau of Standards station WWV. When the tone returns, Eastern Standard Time will be ten, thirty-five, PM". Now what radio person hasn't heard *that* announcement at some time or another? Well, nowadays not too many, I guess, because that's what it sounded like 40 years ago, when I was just starting out in radio. Nowadays it's the 'National Institute of Standards and Technology' (NIST), and the time is given in 'Coordinated Universal Time' instead of Eastern Standard. But it's still the same old WWV, and its sound has changed remarkably little since the station started making voice announcements back in 1950.

WWV actually came on air from Washington, D.C. in 1923, although back then it was a fairly limited time-tick and frequency standard service without the spoken time calls. By the time it started talking, WWV was firmly settled in Greenbelt, Maryland; hence the reference to Eastern Standard Time, American style. Two years earlier the station had also set up a branch office, WWVH, on the island of Maui in Hawaii.

Of course WWV was established to serve the time and frequency needs of professional users, but that didn't stop thousands of young radio enthusiasts all around the world from using it too. It served as a useful beacon for starters, because, in theory at least, WWV was always there. If you built or modified or repaired some receiver, you'd test it by listening for signals. And if nothing was heard, you'd try for WWV. And if you couldn't hear WWV on five or 10 or 15MHz, you had big problems.

Where I lived, in Albuquerque, New Mexico, one of the signals from Greenbelt, Maryland, was always there. But for some reason we seldom heard the WWVH service from Hawaii, although the distance wasn't that much greater. Must have been that the after-school 'playing radio' time favoured propagation from the east.

Speaking of time, I used to set every clock in the house to WWV, boring everyone else in the process. I'd tune the station on my shortwave radio and then turn it up nice and loud as I went around checking and setting the clocks. The station would drone away with its tones and ticks with the time announcement every minute.

I used to visualise what went on at WWV as I listened to it. There was this very distinguished gentleman sitting in a studio in front of an enormous microphone. In front of him there was nothing but a large wall clock, and every time the second hand would come around to 45, he'd do his thing — day and night. There was only one announcer, so he obviously worked 24 hours a day.

His counterpart in Hawaii was a woman, so you could tell the two stations apart by their voices. There they were, thousands of miles apart. I wondered if they knew each other... did they send out secret nothings to each other over the airwaves?

Boulder HQ

With those memories in mind I descended on the modern headquarters of WWV, now domiciled in Boulder, Colorado. The actual WWV transmitter is now at Fort Collins, about 100km north of Boulder. WWVH has also moved to a different Hawaiian island, called Kauai. All these places are 'a little bit of Heaven'; one wonders if they were chosen for the benefit of the staff, as well as the transmitters...

As for those announcers, that romantic illusion was quickly shattered. They were both 'things', called Autochrons, not humans at all. At least the Autochrons didn't mind working 24 hours a day, and they certainly didn't get bored reading the time

The WWV station building at Fort Collins.

out every minute for their entire working lives.

The Autochron was the 'talking clock' of the pre-digital age. It was basically a big rotating magnetic drum with many tracks recorded upon it. The track to be played was selected by a head that moved along the drum, in the style of the old Edison cylinder phonograph. So one track always said "This is National Bureau of Standards station WWV. When the tone returns, Eastern Standard Time will be...". Then the head moved to the track that said "ten", and then to the track saying "thirty-five" and finally to "PM".

The tracks were of course originally recorded by human persons, with names and personalities. I can now reveal that the man's name was Don Elliot, just for the record. As for the voice of WWVH, she made her recordings in Atlanta, Georgia, and probably never went anywhere near Kauai — a pity. Her name was Jane Barbe. I will resist the temptation to refer to her as WWV's Barbe Doll...

The Autochron produced absolutely lovely audio, very natural sounding. But time marches on, and electromechanical devices became hopelessly obsolete. So about four years ago the Autochron's functions were taken over by a digital contraption called a time-code generator. This device produces the tones, the ticks, the BCD time code, the voice time announcements, the service announcements, and everything else that makes up the WWV program, all in the one magic box.

The time-code generator was specially designed for WWV use, with several of the instruments being produced by an outside contractor. Of course, with the Autochron gone, it was necessary to re-record all the bits and pieces of the time announcements, this time for programming into computer memory chips. Instead of moving a head along a drum, the time-code generator only has to generate sequential memory addresses to point to the stored digitised speech. Very simple, very reliable, and very high quality.

Trouble is, WWV listeners didn't like it. The new announcers were non-professionals, hired by the company that made the time-code generator. Jane Barbe was gone — replaced by, as a WWV spokesman said, 'somebody's girlfriend'. And Don Elliot's replacement wasn't much better.

After a flurry of listener complaints, it was decided to try to get the original voices back again. WWV tracked down Don Elliot, but he had long retired since making the original recordings 40 years ago, and his voice just wasn't up to it. But after a long search, a fellow named John Doyle was selected to re-record the speech memory chips. His voice was very 'neutral' and he sounded much like the Don Elliot of old.

As for the female voice, WWV managed to drag Jane Barbe out of retirement for one more performance. Her voice is just as nice as it was 40 years ago, and she evokes images of a swaying body in a grass skirt as she finishes each announcement from Kauai with "Aloha". So now, it's John Doyle and Jane Barbe, the 'John and Jane Show' on WWV.

Another spoken service on WWV is the provision of announcements having nothing at all to do with time or frequency, such as storm warnings for ships on the high seas, status information on the Global Positioning Service (GPS) satellite navigation system, status on the older Omega navigation system, and geo-alerts. These usually sound somewhat scruffy compared to the beautiful audio provided by the digitised voice part of the time-code generator.

This is because these other voice services are provided by outside organisations such as the Weather Bureau, who simply telephone a special WWV number, enter a secret access code, and record their spiels. So it's the same voice quality you would find on talkback radio. A WWV official said the station was 'leaning on' the outside service providers, trying to get them to use proper broadcasting consoles with decent microphones, but so far without success.

An interesting sidelight is that the current anti-discrimination laws dictate that

The primary cesium beam frequency standard at Boulder, done up in its Christmas colours.

anyone in the employ of the US government must be allowed to record the WWV service broadcasts. So there have been instances of employees with very thick foreign accents demanding to be allowed on air. The result on the other end is a broadcast that is barely understandable, aboard a ship bouncing around in a storm at the wrong end of a fading shortwave radio link. So there is now said to be an 'unofficial' arrangement ensuring that whoever records the services is a good English speaker. One thinks it might not be wise to ask too many questions concerning how this came about.

Technicalities

Enough of WWV's history and personalities! This is supposed to be a technical magazine after all, so let's get down to the nuts and bolts of WWV's time and frequency services. These are provided by fairly ordinary transmitters at two sites — WWV at Fort Collins, Colorado, and WWVH at Kauai in Hawaii. Both stations run 10kW on five, 10, and 15MHz, with the Fort Collins site adding 2.5 and 20MHz with 2500 watts. WWVH runs 5kW on 2.5MHz but does not transmit at all on 20MHz.

The antennas at Fort Collins are all traditional half-wave dipole types, which would result in quite lofty towers for the 2.5MHz version. In contrast the antennas at Kauai are phased vertical half-wave dipole arrays, which radiate cardioid patterns toward the west. A large proportion of the gain would also be toward the south-west, which explains why WWVH has such a healthy signal in Australia. Kauai's 2.5MHz antenna is a half-wave dipole like the one at Fort Collins.

Fort Collins also runs the WWVB service on 60kHz, using a 122 metre high top-loaded vertical antenna over an extensive system of ground radials. This monster antenna provides an effective radiated power of 13kW in all directions, resulting in a very healthy 00uV/m field strength as far as the east coast of the USA. WWVB should also be audible in Australia, to people who can receive on such a

***Left:** WWV engineer Matt Deutch opens the final amplifier section of a 10MHz transmitter at Fort Collins. **Right:** WWV engineer Charles Snider tweaks one of the time code generators. Note the nixie tube readout — this is obviously not the latest model.*

low frequency.

A Hewlett Packard secondary cesium beam standard.

We mentioned that the WWV transmitters are pretty ordinary, but the oscillators that control them certainly are not! Let's start at the beginning, with the primary atomic cesium-beam standard in the NIST headquarters at Boulder, Colorado. This device has its own atmosphere-controlled room, into which mere mortals like me are not allowed to go. The photo was taken through a double-glazed window a few days before Christmas last year, when the cesium standard was dressed in red candy-stripe Christmas colours, with the nearby electronics package wrapped up as a gift from Father Christmas. It's good to see the cesium standard's masters have a sense of humour!

However life goes on within that long white tube. There's an oven at one end, containing cesium metal, heated to around 100°C. At the other end is an atom detector, and in the middle a microwave oscillator to get the atoms vibrating. There's a feedback arrangement between the atom detector and the microwave oscillator, to trim its frequency so that the whole system settles into a nice easy resonance at precisely 9,192,631,770Hz.

And that, my friends, is used for the definition of a second, at least in the USA. When those cesium atoms have jiggled nine billion, one hundred and ninety two million, six hundred and thirty-one thousand, seven hundred and seventy times, one second has passed. No more, no less.

That may be a strange resonant frequency, but it is very constant, to the tune of one part in 10^{-14}. With lots of digital trickery the 9GHz oscillator output can be divided down into more useful frequencies, including one pulse per second which drives a digital clock hanging from the ceiling above the standard. It would be very hard to argue with that clock!

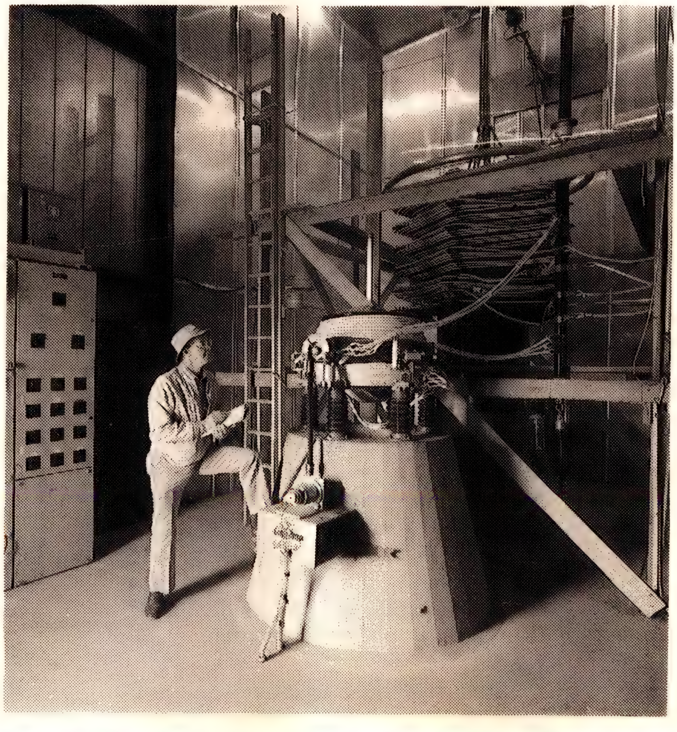
The time and frequency standard in that room in Boulder does not drive the transmitters at the WWV radio stations. They are controlled by much smaller cesium beam standards made by Hewlett-Packard. This instrument uses a resonator tube about 200mm long, compared with the big fella at Boulder which is about four metres long.

The H-P standard fits into a standard 19-inch rack and weighs something like 60 pounds. With a price of around $60,000, that comes out at around a thousand dollars a pound for one instrument. No wonder everyone held their breath as I hefted the thing into a chair to take its picture. Had I slipped, it would have been more than my toe that hurt!

Each of the transmitter sites has three of the H-P standards, which are in control of all frequency and time functions. The H-P units can be referenced back to the primary standard by linking *them* through a satellite that can see both the transmitter site and Boulder at the same time. The WWV transmitter frequencies are thus held to within 1 part in 10^{-11} — certainly not as good as the Boulder standard, but still within one part in 100 billion.

Output from the H-P cesium standard is basically 5MHz, which can be multiplied up to 10, 15, or 20MHz, or divided down to 2.5MHz, to serve as the carrier frequency for the transmitters. A standard frequency is also fed to the time-code generator mentioned above. This signal is divided down to produce the 600, 500, and 440 audio tones emitted by WWV, as well as the frequencies and timings to produce the various ticks and tocks.

And finally there IS a time code, coming from the time-code generator, a modified version of the one bit-per-second IRIG time code used on missile test ranges. (IRIG means 'International Range Instrumentation Group', as I remember...) Within a one-minute frame (60 bits) the system encodes BCD representations of the year, the days (out of 365), the hours, and the minutes. The time code is heard as beeps and boops of 100Hz subcarrier below the other WWV audio, with short boops for binary zeros and long boops for binary ones. Using a 100Hz tone detector it should be dead easy to decode this stuff with a computer.



Inside the 'Helix House', the base loading coil for the 60kHz WWBV antenna. The device in front is NOT left over from a Dr Who film.

What about VNG?

With all this whizz-bangery at WWV, it's easy to overlook the home grown product, Australia's own VNG time and frequency

Continued on page 33

AUTOMOTIVE ELECTRONICS

with **NICK de VRIES** MIAME, AMSAE, FI Diag.E.

The ABS braking system

In this month's column, I have decided to do my best at providing an overview of what has become widely known as the ABS braking system, which embodies a combination of electronic and hydraulic systems. I'll also touch on TCS (traction control system).

The term ABS refers to the 'Anti' or Anti-lockup Brake System, as developed by numerous vehicle manufacturers world-wide. In effect, the ABS systems in use on today's motor vehicles work against the driver's best efforts to lock-up the wheels in a panic stop situation.

Sensors at the wheels detect the rotational speed of each wheel (Fig.1), and a control unit compares all four inputs. The Electronic Brake Control Module (EBCM) is able to vary the hydraulic system pressure in a rapidly pulsating manner, to restore traction and braking torque if one or more of the wheels is tending to skid, thereby ensuring a controllable vehicle in all road surface conditions.

Well, that's what the advertising blurb would have you believe — and if you did, you're exactly the kind of person they want to meet in their showrooms!

In reality the efficiency of the ABS derivatives is a complex series of engineering compromises, and nowhere near as simple as the sales brochures would have us believe. If it were possible to have some sort of intelligent system that automatically detected the type of road surface as well, we might have the beginnings of a foolproof arrangement. If all tyres had the same coefficient of adhesion and all roads had the same coefficient of friction, things would be simple indeed for the staff at our vehicle manufacturing design centres.

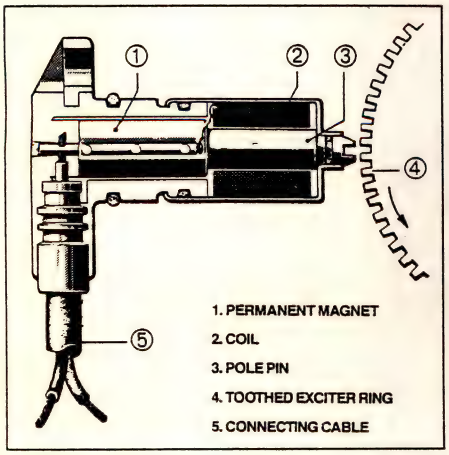


Fig.1: The construction of an ABS wheel speed sensor and rotor.

Imagine the system intelligence that would be needed to differentiate between wet cobblestones, ice, snow, gravel, bitumen, concrete and you name it. Each of these surfaces has widely different braking requirements for the best stopping distance...

I should point out at this juncture that the ABS only comes into operation if, and when, the electronic brake control module detects the onset of a lock-up condition; and not before. If you never brake hard enough to induce a skid, you would be completely unaware of the added weight and complexity in your braking system. (Some manufacturers have been known to resort to heavier springs on one of the front wheels to cope with the extra weight!)

Slip vs. grip

The critical part of the ABS equation is the amount of slippage the system will allow. That's because *some* slippage actually assists in braking the vehicle, by increasing the tyre 'grip' on the road. Probably the best amount of slippage for maximum deceleration (that's lateral-force coefficient versus braking-force coefficient, in engineering speak) is around the 10% to 20% mark, for dry road surfaces made of bitumen — see Fig.2.

When I learned to drive, about 20 years ago, I came away with the misconception that the best braking was achieved just before lock-up. This is true for ice, but it turns out that there are levels of slippage that are beneficial depending on the road type. It is actually better to have the road surface grinding away at the tyres slightly — which is hell on the tyres, but a vast relief for both driver and pedestrian in an emergency stop.

Consider the complexity of the ABS controller's job. Not only must all manner of possible variations in road surface be taken into account, but sudden changes in road surface must also be accommodated. If a wheel goes from slippery gravel to clean bitumen, as in the case of the left front wheel coming off the road shoulder back onto the road surface, the controller must be able to respond swiftly to prevent the vehicle yawing uncontrollably.

Wear and tear in the brake system must also be predictable. If the brake disc rotor becomes distorted, causing brake hysteresis (shuddering), the con-

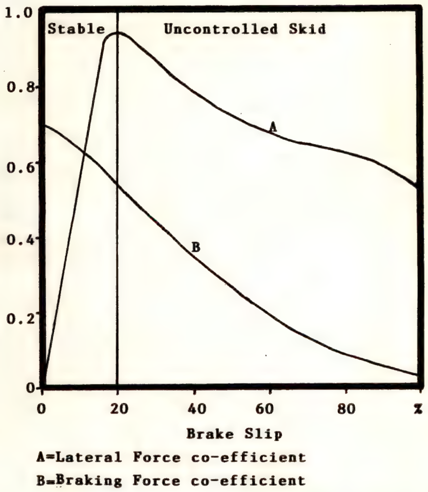


Fig.2: Slip versus Grip. This graph is a rough guide only, as each road surface is different and tyre condition plays an important role.

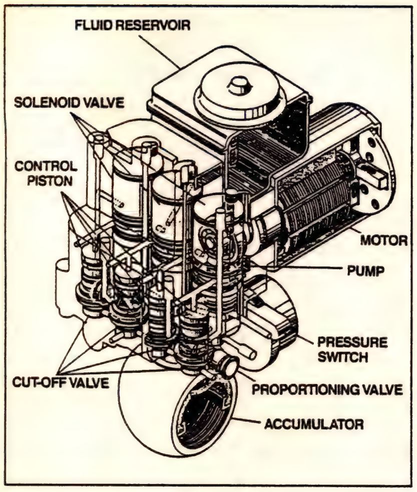


Fig.3: The ABS Solenoid Valve Body and Pump assembly as used by Ford

troller needs to be able to distinguish between this phenomenon and road conditions.

Differing market needs

When a vehicle is programmed for a particular market, the potential road conditions must be taken into account so that the prospective owner doesn't have an 'Oops'. For example, the allowable slippage on black ice is precisely zero, whereas the desirable slippage on snow and gravel might be only 5-10% — which will have the wheels constantly trying to climb up a wedge of snow or gravel, and thus giving reasonable grip and steering.

Setting the thresholds for an Australian vehicle is therefore going to be a bit of a compromise between the likely conditions for Kingaroy versus Kosciusko. The owner of a vehicle living near the 'Frigid Zone' will want a car that doesn't lock the wheels on ice, whereas the Kingaroy peanut farmer will want to be able to stop well before a stray kangaroo crossing his path gets within impact distance!

Driving a vehicle with a Scandinavian ABS program on outback Australian dirt roads might result in just about managing to stop the vehicle in about a kilometre or so in panic stop mode, as the ECBM (or should that be ICBM?) tries to achieve zero slip — when 5-10% would be ideal!

Steering

The aspect of steering raises another point of interest. A locked wheel has a negative steering value, as anyone who has tried to brake with one wheel on a wet tram track in Melbourne will darkly confirm.

The trams drop sand(!) in front of their wheels, to try and achieve some semblance of traction. This of course does wonders for the cars' stopping distances when the sand dries out on the next sunny day — mumble, mumble. (Ban the trams, I say!)

Different types

Since the introduction of ABS in the early to mid 1980s, a number of differing variations have appeared on the market — offering a range of benefits/complexity depending on market position (i.e., cost) of the vehicle manufacturer's products.

The simplest form of ABS is the 'rear wheels only' type, which assists the controllability of the vehicle by preventing the rear wheels from locking up and thereby rendering their steering value useless. This is a relatively simple 'add-on' system with one or two speed sensors, a hydraulic in-line actuator and the electronic control unit, requiring a minimum of engineering to install.

The most exotic systems are usually used in conjunction with Traction Control Systems (more about this later), and have sensors on all four wheels plus a complex hydraulic unit comprising motor, pump, proportioning valve, pressure switch, control pistons, cut-off valves and accumulator. Fig.3 shows a sectioned view of a Solenoid Valve Body assembly, detailing the componentry involved in directing the pressures.

ABS operation

There are four main phases of operation in the ABS system:

1. Most of the time the controller is in the 'watch, but do nothing' phase, where everything is OK and no slippage is detected by the wheel monitors.
2. If any of the wheel sensors detects a sharp rise in deceleration compared to the others, the ECBM assumes that the wheel concerned is approaching lock-up and starts to prevent more pressure being applied to that wheel.
3. If the wheel speed does not increase to the level of the other wheels, phase 4 begins...
4. The driver of the vehicle may now notice a 'hammering' effect on the brake pedal in severe circumstances, as the high pressure pump works to push back against brake pedal pressure and apply a 'grip-slip' sequence of pressure pulses to the brake caliper/s.

The frequency and intensity of the pressure pulsations vary depending on vehicle weight and speed, as well as whether the offending wheel is returning back to the same speed as the other wheels. See Fig.4 for a graph of the ABS operation.

Traction control

Traction control or TCS is a natural extension to the ABS concept, as it shares the ABS sensors to obtain information about wheel spin during acceleration. The control mechanism can be achieved in several ways.

Firstly, the ABS swings into action by applying brake pressure to the wheel that is accelerating too fast, which has the immediate effect of increasing the engine torque to the other driving wheel, to 'balance' the load. This method is not dissimilar to applying the hand brake slightly when trying to drive out of a bog, thus making sure that both the driving wheels pull together.

Secondly, in the case of *both* driving wheels spinning, the engine management system, if fitted, can be instructed to reduce the power output by means of a reduction in ignition advance, fuel injector pulse width, or both.

The upshot is that a vehicle fitted with ABS and TCS can be driven away at full throttle from a standing start on snow, for example — with the consequent embarrassment of having the back of the vehicle trying to pass the front in the Thredbo Village car park!

It is interesting to note that traction control systems have been banned in some forms of motor sport because they are regarded as an unfair 'driver aid' — it is a bit like giving a shield to a gladiator, I suppose.

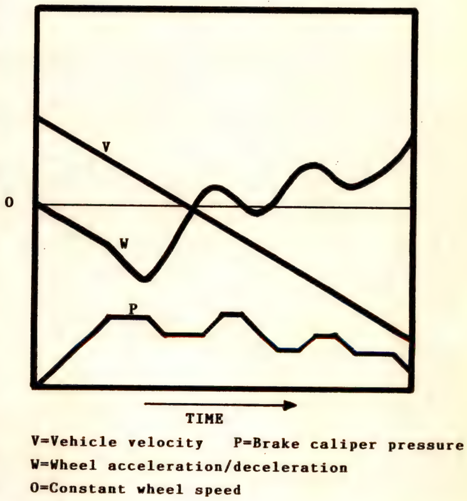


Fig.4: Typical ABS graph depicting brake caliper pressure, vehicle deceleration and positive/negative wheel rotational acceleration characteristics.

One way to get around the ban has been to introduce a gearbox sensor to determine which gear is selected and vary the power output of the engine, by using an alternative look-up chart or engine map purely to prevent wheel spin. The net result is that a fire-breathing slingshot can become quite driveable, and anybody with the required amount of chutzpah can hop in and plant the appropriate foot on the loud pedal without disappearing in a billowing cloud of tyre smoke and vapourising $$$ worth of tyres...

Motorcycle racing's fastest road rockets are quite unmanageable in first gear when the rather peaky power band is reached, and riders have to avoid hitting the power zone — or risk being spat off just a few metres from the starting grid!

In car racing, scenes like Peter Brock breaking an axle on the starting grid the year he was allegedly going to "drive like the devil" will become a thing of the past, and full throttle launchings will be possible simply, through the application of careful programming on practice days.

Injec Racing update

In the January edition of *EA*, I reviewed the Injec Racing Developments engine management controller model EM1, which was a 'fuel only' system produced in Melbourne's Airport West. Time has passed and the creative geniuses at Injec headed by Phil Lamovie have released the EM2, which includes a mappable ignition advance curve as well.

Perhaps a future model will include just such a 'gear select' input and multiple maps as I have described in the previous paragraph?

And speaking of racing developments, the ABS and TCS derivatives are directly attributable to the racing fraternity. It may have taken a few years for the technology to trickle down to affordable cars, but eventually today's leading edge is tomorrow's bread and butter.

Semi-trailers

A system in use on semi-trailers for the past few years, involving the deployment of a roll of very strong fabric designed to provide a better adhesive surface for the tyres, has met with great success. Under emergency braking conditions only, the roll of fabric is released just ahead of the trailer wheels and when fully unrolled the end still attached to the trailer pulls taut, and effectively locks up the wheels. Such is the improvement in the braking force coefficient that it's a wonder tyre manufacturers aren't considering making tyres out of the stuff!

Conclusion

All we need now, to make cars really civilised, is the electronic systems to steer around corners, predict gaps in the traffic, automatically select the best course to reach your destination and serve the coffee. But for now, that sort of service is called 'first class' and rides on rails...

A well sorted ABS and TCS system is essentially a good thing. Not everyone has the ability to maintain a cool head in an emergency situation — but is this an indication that our system of driver training is inadequate?

When the demands for safer roads outstrip the inventiveness of the engineering profession, will the 'political will' be there to install a high grade training/retraining regime to improve the road toll statistics?

There I go again, getting all philosophical and misty-eyed about the future. When all's said and done, it is still advisable to drive carefully and leave plenty of space between yourself and the indeterminate quantity in front of you.

See you next time. ❖

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WORLD OF WWV

Continued from page 29

station. This one has had an interesting if rather tragic history itself, being declared redundant and closed down by the government like just another out-placed employee.

But VNG wouldn't lie down and die; it was resurrected by lots of effort and sacrifice by a 'VNG User's Consortium', made up of people who didn't think the station was redundant at all. In fact it has proved to be a valuable resource to Australia because radio signals from far away stations like WWV can have their accuracy totally destroyed by effects like varying propagation path lengths and times.

Latest news from VNG is that their old tape-based time announcing system has finally gone to silicon heaven, replaced by a brand spanking new AWA digital announcing machine.

This device was privately donated by VNG Users' Consortium member Mr Peter Lord. Now it's chattering away quite happily, making good clear time announcements once a minute in a female voice. There are also some transmitter upgrades in the works, so VNG is looking and sounding pretty healthy at the moment.

And some interesting news from Boulder is that the NIST is busy building a satellite earth station, for the sole purpose of communicating with Australia. When the system is complete, it will provide us with a feed from the candy-stripe primary cesium standard, with time signals to an accuracy of one nanosecond. ❖

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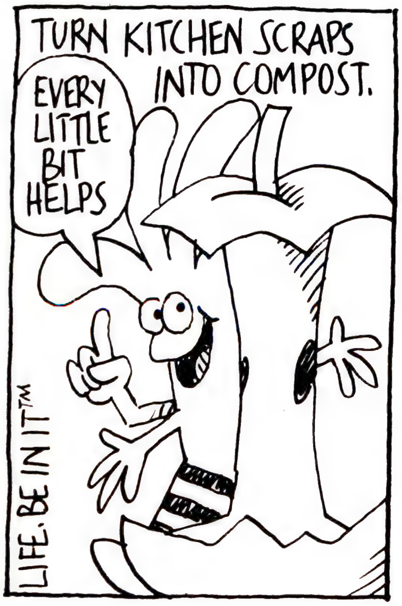

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READER INFO NO. 7

When I Think Back...

by Neville Williams

Victor Harris: Sought top performance from analog discs, with his own two hands - 1

Born in Wolverhampton UK on January 15, 1919 but based in Australia, the late Victor F. Harris devoted much of his working life to the development of 'MBH' phono pickups and a number of other products related to high fidelity reproduction from phono discs. He is perhaps unique among hifi pioneers in that, with his death a few weeks back, he has left behind a group of dedicated supporters who are already taking steps to perpetuate his memory and his work. Their cooperation has made possible this present article.

Vic Harris was very much a creature of analog technology, and it is ironic that his life's work should end about the time when analog thinking has been overtaken by the digital approach to recording. It is essential to understand the difference between the two to appreciate what Vic was all about. So let's restate the relevant audio basics:

Sonic phenomena occur when something initiates a train of pressure waves in the surrounding air, having a repetition rate or frequency in the so-called 'audible' range. For a person with good hearing, the faculty extends from about 16 hertz at the bass end to an upper limit of about 16,000Hz (16kHz).

Most of the sound we are concerned with in everday life is a complex mix of frequencies which combine to produce an on-going sonic pressure resultant, representing the instantaneous sum of all these sound pressure components plotted against time.

In turn, this complex pressure variation sets up a corresponding vibration of our eardrums. Amazingly, the human ear and associated brain functions can analyse the contour of the sound pressure resultant to sense the component frequencies — be the source(s) as random as chatter in a noisy environment, or as deliberate as a recital on a grand organ!

In creating a conventional disc recording, the sound pressure energy is employed to vibrate the recording stylus, originally by mechanical means or, more recently, by electronic technology. By vibrating the stylus tip from side-to-side (in the simplest case) the helical groove inscribed on a disc deviates accordingly — becoming, in effect, an on-going miniature graph of the sound energy being recorded. The result is described as a 'lateral' recording (see Fig.1).

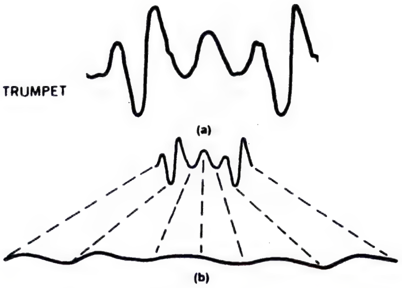


Fig.1: (a) represents a few cycles from the sound pressure wave of a trumpet, while (b) suggests how the same waveform might look as the segment of an analog groove in a laterally recorded disc.

For playback, the needle tracks the modulated groove, its resulting pattern of vibration resembling that of the original sound pressure pattern. When the recovered vibration is made audible by mechanical or electronic means, listeners hear a reproduction of the original sound.

The 'analog' method

The central feature of this process is that it seeks to preserve the shape of the original sound pattern in a different and tangible form — inscribed in a groove in a disc. When replayed, the physical 'recording' is translated back into sound having a similar pressure pattern to the original. This is described as the 'analog' approach, with each step imitating or being an analog of the one before.

Phonographs and gramophones up to and including the 1920s offered a relatively poor quality of reproduction, because the ultimate sound was compromised by inherent mechanical peculiarities or 'artefacts' of the cutter/groove/stylus analog processing, most obviously:

1. The mix of shellac and a granulated filler, used to form the early disc pressings, added an extraneous noise background of scratch, clicks and plops.
2. Mechanical resonance effects in the cutter and playback mechanism exaggerated the mid-frequency range, producing what was commonly described as an unnatural 'metallic' quality, lacking in deep bass and bright top-end sounds.
3. Variations in groove shape and frequency response, as recorded, affected the compatibility of some records and some players, further degrading the sound quality.

Listeners in the 1920s had little option but to put up with such limitations. Suppliers, by and large, were more intent on meeting market demands than on devising better technology.

During the 1930s, however, with the

growing popularity of radiograms, the release of crystal pickups proved a notable step towards better sound from disc, with increased available signal, less dominant mid frequencies and extended bass response.

Crystal pickups came to dominate the domestic record player market during the 1940s and 1950s, and along with gradual improvements in the quality of 78rpm pressings, customer expectations of new records and record players put pressure on the industry at the everyday shop-floor level.

Hifi in the thirties

But so also did the expectations of 'hifi' enthusiasts, who set up a world-wide clamour for better than average discs, pickups and amplifier systems.

It was evidenced in this magazine, for example, when Editor John Moyle and staff dreamed up the 'Playmaster' series of do-it-yourself amplifiers, with circuitry to compensate for different makes of 78rpm discs, along with *ffrr* (full frequency range response) and fine-groove pressings, and the proposed 45rpm and 33rpm microgroove formats.

In the process, it became apparent that commercial crystal pickups did not lend themselves to accurate frequency compensation, and that the future of hifi reproduction lay in high quality magnetic types. In other words, to recapture an accurate analog signal from the improved records, there was an acute need for precision magnetic pickups.

Nor were we alone, with other audio-hifi magazines worldwide carrying a similar message. It was an audio setting tailor-made for a man like Vic Harris, whose burning ambition was to produce Australian-made pickups and other equipment which could reconstitute programs off disc as free as possible from the persistent artefacts of the analog system: background noise, distortion and limited frequency response.

According to his friends, Vic was a hifi purist/perfectionist who tended to reserve judgment on anything that he hadn't worked on himself, with his own two hands! If any aspect of analog mechanics could be refined, they said, Vic would do his darndest to find a way to achieve it!

Peter Stinson of Dee Why, NSW, who organised much of the material for this

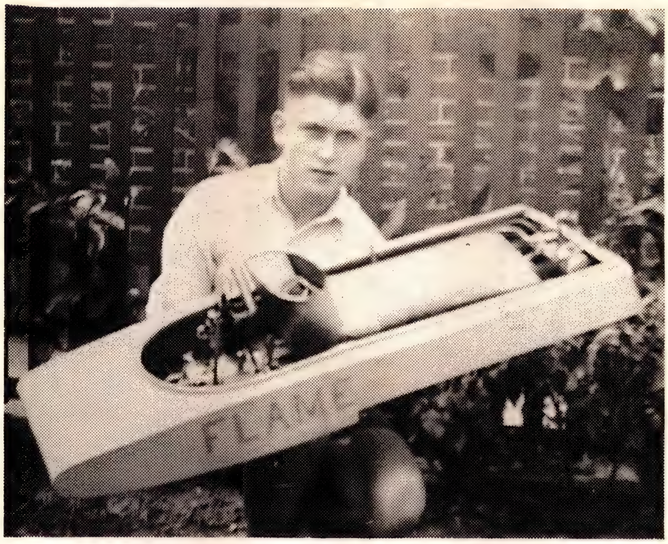


Fig.2: The late Vic Harris, photographed with his first steam-powered model boat around 1935. Such projects honed his skills for engineering in miniature. (Photo courtesy Peter Stinson).

Fig.3: Looking very much the groom, Vic Harris with his new wife Mary in the late 1940s. They set up home in Croydon, handy both to Vic's original workshop in Ashfield and his subsequent factory at Flemington. (Photo courtesy Peter Stinson).

biography says: "his committment to quality was complete; so much so, that he was unlikely ever to make a fortune out of it". Again: "He was an extremely nice bloke; that wouldn't have helped, either, in the cut-throat world of commercial hifi!"

Nature's gentleman

Another of Vic Harris' friends, Richard Dibbs, agreed that Vic Harris was a perfectionist — but not to the point where he would ignore the practical aspect. He was quite capable of concluding: "It could be done this way instead of that way, but you'd never hear the difference!"

"Vic Harris was a very clever and knowledgeable engineer" said Richard, "but, first and foremost, I choose to remember him as one of nature's gentlemen."

For my information, Peter Stinson enclosed a set of handwritten notes, covering Vic's work with pickups; notes which Vic had prepared for a talk/lecture given to the NSW Phonograph Society around 1988.

Vic told the members that his parents had installed a radio quite soon after broadcasting began in the UK, but they had never owned a gramophone. They preferred to make their own music, and he suspected that his father disdained 'mechanical' music in the form of the pianola and gramophone.

The Harris family moved to Australia in 1927, mainly because Vic — then aged eight — was suffering from recurrent bronchial problems in his home country. According to his sister Irene, they took up residence in Ashfield, in Sydney's inner west.

In Australia, in his mid 'teens, young Vic came to realise that a whole world of music lay in records. He managed to acquire a spring-driven turntable, to which he fitted a pickup for connection to an existing radio set. Said Vic: "It was to be the first of a number of record players of gradually increasing complexity, with post-war shortages often putting my ingenuity to the test."

That Vic was not the only one with problems became evident when Jack (later Sir John) Tuite made it known that even the PMG Dept was having difficulty in obtaining satisfactory pickups for use by the ABC radio stations. The statement caused Vic to wonder whether he might, one day, be able to produce what they were looking for.

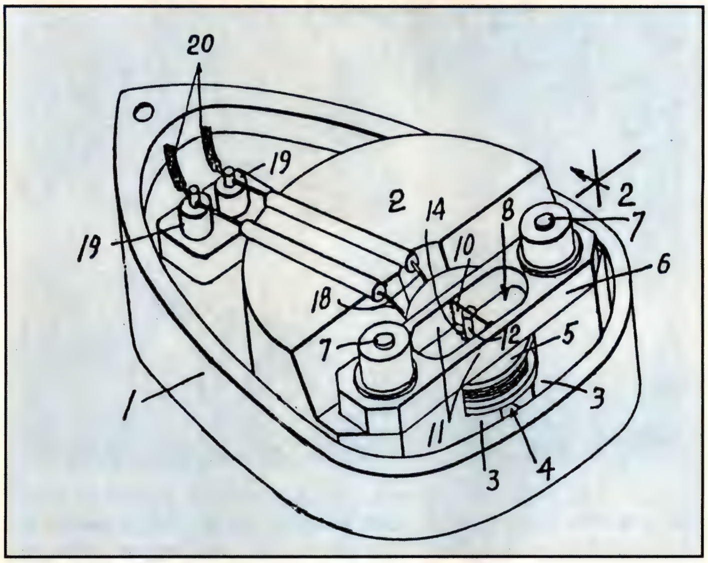


Fig.4: From Vic Harris' own lecture notes, a representation of the original HH pickup head, keyed as follows: 2 is the magnet, 3 & 3 the pole tips and 5 the coil. 10 is the torsion bar and 24 the socket into which the stylus assembly screws from beneath.

Basic skills

It may have seemed presumptive on his part but, by this time, Vic was no stranger to the subject, with a growing passion for classical music. What's more, his father had been a skilled machinist and tookmaker, who had worked in the Sunbeam car factory at Wolverhampton. Young Vic had followed in his father's footsteps, studying fitting, machining, tool-making and electrical trades at technical college in Sydney. He had also become involved in the Society of Model Engineers (Ashfield) who had even adjusted their rules to admit him as a Junior Member.

As such, he built a couple of model speedboats, one of which featured on cinema newsreels (Fig.2). As an encore, he devised a model gyroscopic train which performed on a single track laid around the family backyard.

Those who knew him agreed that Vic had a very practical turn of mind. He could think his way through mechanical problems, devise tools and draw up engineering plans. He was also very systematic, and kept detailed files of everything he did.

During the 1930s, Vic had also worked for a time at Paton Electrical Instruments and at Magnavox as a foreman, where he was exposed respectively to instrumentation and loudspeaker technology.

At a personal level, according to his sister, Vic was a keen bushwalker, played social tennis and founded a Discussion Club which debated a variety of topics in one another's homes.

As an active member of the Peace Pledge Union, he refused to enrol for wartime service, although offering to undertake non-combatant duties. In court, the judge accepted the sincerity of his beliefs and imposed no sentence.

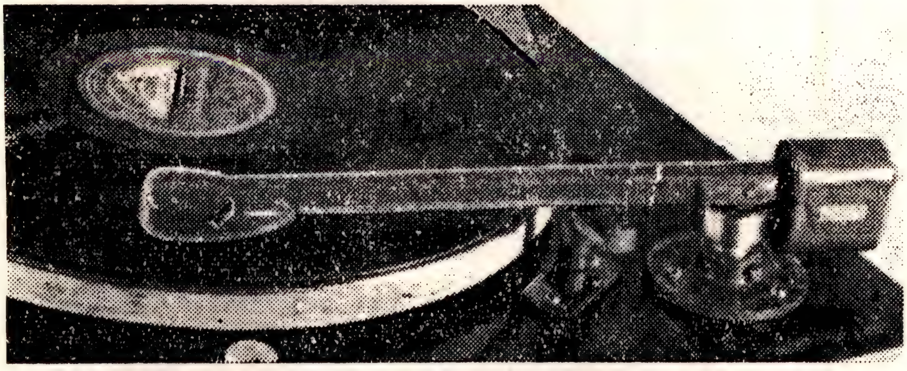


Fig.5: The HH (Hummelstad Harris) hifi pickup, as announced in the November 1949 issue of 'Radio & Hobbies' magazine. Outstanding at the time, it marked the beginning of Vic Harris' career.

Vic married Mary in 1947 (Fig.3) and settled down in nearby Croydon to a quiet way of life with his classical recordings, current literature on applied science and his workshop.

Backyard workshop

In 1946, he had opened his own small machine shop business in the backyard of the family home in Knocklayde Street, Ashfield — close to the one-time AWA site. Here he was finally able to pursue the design of professional grade audio equipment. The basic trouble with pickups of the day, Vic reasoned, was that the needle/armature combination was far too heavy, with the natural resonance occurring in mid-spectrum and so pronounced as to require stiff rubber damping, thereby compromising the basic compliance of the system.

Vic reasoned that if he could make the assembly light enough, the resonance would move up to a frequency where sufficient damping could be provided on the stylus tip by the record material itself. While a shellac pressing appeared to be hard, he said, its texture as sensed by a stylus tip was in reality 'somewhat rubbery'. The texture of an acetate disc was even more so.

After a few attempts, around 1946, Vic produced a head with a resonance around 14-15kHz. The resonance amplitude was relatively low and well outside the currently recorded range. (At the time, EMI recorded through signal filters which rolled off above 6.5kHz.)

The stylus tracking weight of the new head was 14 grams — very modest for the period — and its nominal output was about 10mV (-45dB) from a source impedance of about 500 ohms.

His first patent on pickup design, based on the above, was granted during the following year, being featured as a new product release in the November 1947 issue of this magazine, then called *Radio & Hobbies*. (See Figs.4 and 5.)

This same pickup was described in Vic's lecture notes as a 'leakage flux' type, with the shank of the sapphire stylus serving as the armature. The stylus assembly — or shaft — had a 16BA thread on its upper end and a Morse taper on the lower end just above the sapphire.

For the stylus to screw into, a tiny socket was brazed onto an overhead torsion bar. A special tool like a diminutive socket spanner engaged the Morse taper to insert or unscrew the stylus.

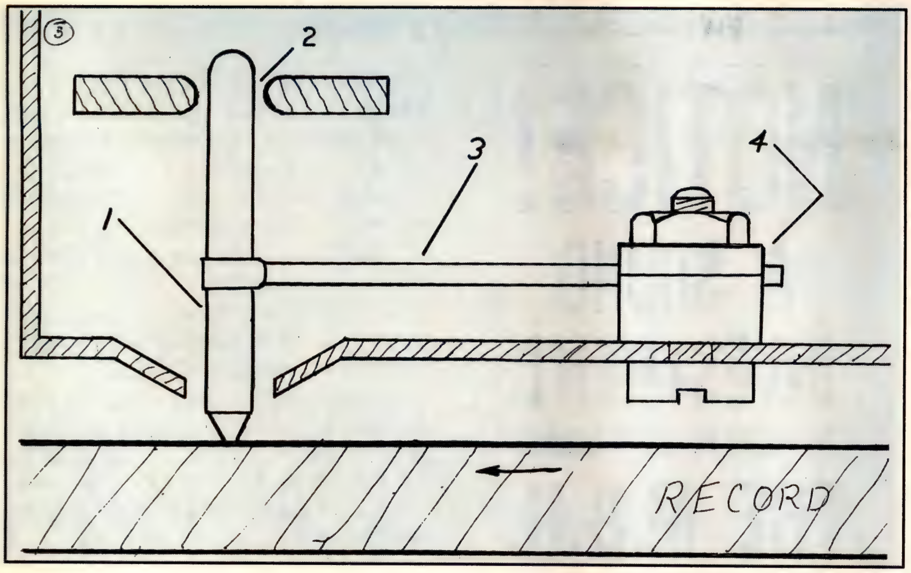


Fig.6: Adapted from Vic Harris' own notes, this sketch provides a keyed side-on plan of the MBH-D mono pickup head. 1 is the stylus assembly-cum-armature, which passes through the clearance hole 2 in playing mode. 3 is the spring support wire and 4 the adjustable clamp.

Jewel styli queried

By reason of the modest playing weight (for those days) and the high compliance, the playing time for the sapphire tip was rated at 200 hours with shellac pressings, and higher for acetates. In fact, despite Edison's earlier endorsement of jewel styli, some of Vic Harris' potential customers seemed to be more concerned that jewel tips might damage their recordings!

Vic's design also faced the problem of needing a step-up transformer or a preamplifier with about 10 times gain, to boost the output to that of the older, heavy magnetic types.

Despite such reservations, Vic said that he sold more than 100 such pickups, many of them going into broadcast stations, where the provision of a transformer or preamplifier posed no problem. This 1947 pickup was branded as 'HH' in recognition of Greg Hummelstad, who was said to have partnered Vic Harris in some peripheral activities to do with audio transformers, filters and amplifiers.

The most notable flaw in the HH design was that the stylus had very little vertical compliance, and no provision to retract if accidentally dropped on to the disc. For that matter, neither did many — or any — other pickups on the market at the time, but the HH was arguably more vulnerable because of its jewel stylus.

According to Vic's sister, Vic and Greg Hummelstad went their own separate ways following the release of the HH pickup. Vic set up a small factory at nearby Flemington, to pursue phono and allied technology; Greg chose to specialise in cinema sound systems.

About this same time, Decca also released a new high performance pickup which was commonly assumed to be similar in principle to the HH. In fact, said Vic, it employed a conventional T-shaped armature and relied on conventional rubber blocks for damping.

1950 saw a move by the record companies to raise the cutoff frequency of their filters to 8kHz, then 10kHz, and finally removing them altogether. This done, it transpired that cutting heads designed by A.D. Blumlein for EMI were able to cut reasonably flat to 20kHz, evidenced by the issue of their test disc ED1189.

20kHz on a 78 disc!

This was quite an accomplishment at the time, and I have a vague recollection that it was demonstrated to the Sydney Division of the IRE by Sir Ernest Fisk, who was by then Managing Director of EMI in the UK. Unable to hear 20kHz, the audience could only gaze with wonderment at the sine wave on a CRO screen!

In his lecture to the Gramophone Society, Vic Harris recalled that Blumlein's cutter had out-performed all 78rpm pickups currently available on the market. Even though well above average, the original HH model clearly had to be upgraded — or superseded — to extend the frequency response and provide vertical compliance for the jewelled stylus. Simply reducing the stylus mass of the original HH was not an option, because even by halving the moving mass, the resonance would still fall short of 20kHz. The output would also be reduced to an impractical level, relative to noise, for the valve preamplifiers of the day.

So Vic Harris addressed himself to a completely new leakage flux design, which was branded 'MBH' — which, he

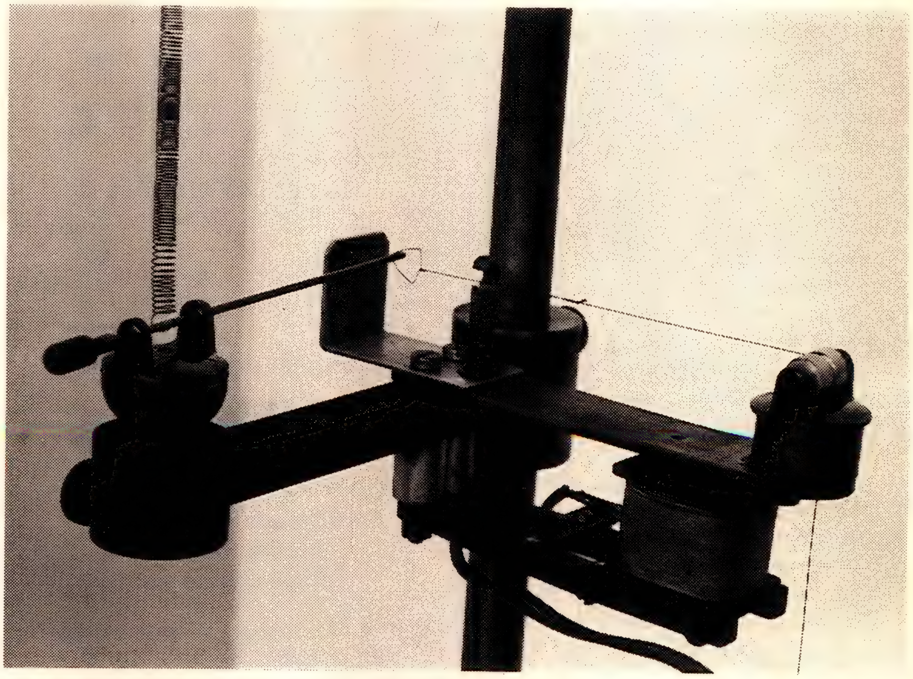


Fig.8: The torsion balance used in the MBH factory to adjust the groove tracking bias spring in the Equidyne arms. It resembles the thread and counterweight system used by some rival brands.

said (somewhat tongue in cheek) meant 'Made By Harris'. The letters also happened to be his wife's initials...

In the new MBH type 'A' pickup, the stylus was supported from behind by a single spring wire 'chuck'. The front end of the wire held the stylus near its centre; the rear end was locked under an adjustable clamp, which provided a centring facility, allowing the stylus to move both sideways and vertically. The top of the stylus assembly was able to move up through a guide hole in the housing, having a critically small clearance. Vic went on to explain in the lecture that the function of the guide hole was both complex and critical. Most obviously, it allowed the stylus to retract upwards in the event of the pickup being dropped on to the record — an omission in the HH design.

Fixed counterweight

Under normal play conditions, the forces on the head were designed to interact with the chuck support spring such that the jewel tip was suitably exposed, with the chuck itself stabilised halfway between the stylus tip and the clearance hole. It was mainly for this reason that MBH pickups had no provision for an adjustable counterweight, the correct — and critical — tracking conditions being pre-adjusted at the factory.

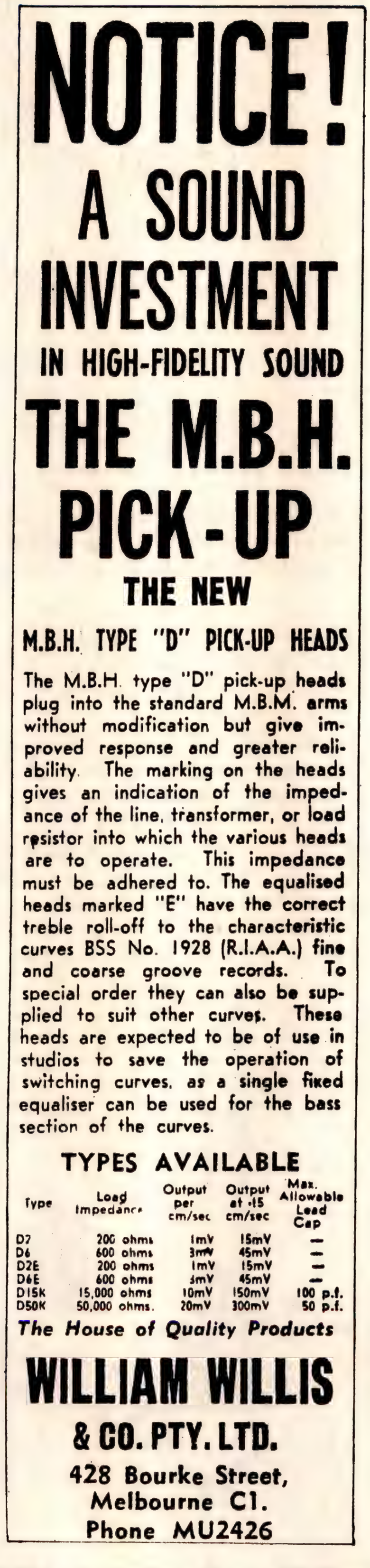
In normal playing mode, the groove drag on the stylus tip tilted the top of the stylus back against the rear surface of the clearance hole, which became a virtual top pivot for the stylus assembly. With the lower tip of the stylus gripped by the groove and the full length of the stylus vibrating within the magnetic gap, the signal output from the magnet coils was optimised at a nominal signal output of around 60 millivolts RMS.

In the higher frequency range, said Vic Harris, the mass of the stylus assembly affected its behaviour such that, instead of remaining stationary against the rear of the clearance hole, it "tended to float nearer the centre of the guide hole".

As implied earlier, a stylus assembly of this general mass is likely to exhibit a natural resonance of around 12kHz. But when this secondary effect occurred with the MBH design, it caused "the top of the stylus to vibrate sideways because of the guide clearance". To continue the quote from Vic's lecture notes:

"With the top moving one way and the tip the other, the centre where the chuck is simply pivots, the chuck being able to twist. You can see that with a simple twisting movement, the portion of the stylus above the chuck approaches one pole piece as the portion below the chuck approaches the other."

"Thus there is no net magnetising of the chuck due to this movement; consequently no (extra) current is produced in the coil. In short, the (12kHz) resonance occurs, but generates nothing."



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D6E	600 ohms	3mV	45mV	—
D15K	15,000 ohms	10mV	150mV	100 p.f.
D50K	50,000 ohms.	20mV	300mV	50 p.f.

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Fig.7: An indication of why Vic Harris formed such a strong bond with individual customers — six cataloged versions of the top of the range MBH-D mono cartridge.

Vic adds that the pickups in question do have a further resonance mode related to the chuck, occurring at about 24kHz in pickups when "in good order". As such it would lie beyond the audible range.

Off the beaten track

Elsewhere, he says that, from model - A the MBH pickup "was able to play ED1189 disc right up to 20kHz, flat to within about 3dB (which was) way ahead of anything else on the market at that time". The output level was also very satisfactory, being a nominal 60 millivolts from a 3cm/second groove modulation.

If you find the above explanations somewhat bewildering — and off the beaten track — don't be surprised. I faced a similar problem in working my way through Vic Harris' lecture notes! Could I really accept that Vic Harris had worked out the configuration of his new pickup and foreseen the complex vibration modes — all in a single flash of inspiration?

To me, it seemed more likely that Vic's progress from the original HH pickup to the MBH design(s) would more likely have been a prolonged process of development spread over months, even years. Both Peter Stinson and Richard Dibbs agreed that such was probably the case; that Vic Harris tended to ponder at length on the finer points of his products — seeking always to minimise what I described earlier as unwanted artefacts of the analog system.

Early in his personal introduction to the MBH family of pickup heads, Vic says:

"I will point out some important factors. The top of the stylus enters a guide above the coil. In the earliest models, this was simply a hole in the bakelite top plate. The hole allowed the stylus to slide up and down for the retracting action. It also acts as a pivot for the top of the stylus. It is important that the guide does not closely fit the stylus but has a certain clearance."

In the margin between the two pars above Vic has inserted a note, clearly an afterthought, adding: *These are not in the patent spec. Nor does anyone else know them.*

It seems likely that, in planning the new MBH pickup heads, Vic's initial step was to address the obvious need for vertical compliance — hence the spring wire chuck and the clearance hole in the top plate for the top of the stylus. Out of this came the question: What size should the hole be? Neat? Clearance? How much?

At this juncture, I would guess, Vic became aware that the hole had an unexpected secondary effect on the behaviour of the stylus, which he then set about to investigate and optimise. Hence his conclusion that the diameter was 'critical', and his subsequent observations about the various vibration modes of the stylus.

Observation or speculation? Without questioning for one moment the ultimate performance of the MBH heads, I do wonder what Vic's peers might have to say on the matter!

Sufficient to say, four official versions of the MBH pickup head were released, plus variants each carrying progressive refinements: the MBH-A, -B, -C, and -D. In the last of these, the -D type, the stylus guide was fitted with an insert made from a resilient material; but, says Vic, "the hole for the stylus remained critical".

To optimise the heads for playing LP mono records, they were fitted with a softer chuck and the overall mass was reduced at the factory to ensure that (a) the playing weight on the stylus tip would be suitably reduced, and (b) the chuck would be accurately centred between the stylus tip and the clearance hole.

An advert in this magazine (then *R, TV & H*) for William Willis & Co dated November 1957, featured the then available MBH type D heads. Six standard variants were listed, ranging in impedance from 200 to 50k ohms. Still other variants were offered on special order, to meet the requirements of professional studios (Fig.7).

Anti-skating arm

In 1958, said Vic, he introduced an arm for the MBH heads which countered the tendency for a pickup using an offset head or bent arm to climb up the inner groove wall. It had a torsion spring associated with the bearing stem, which was 'wound up' as appropriate in the factory by means of torsion balance (Fig.8).

The idea was referred to in the industry as 'anti-skating', and gave rise to a variety of alternative arrangements by other manufacturers. The MBH arm was patented and referred to as the 'Equidyne' arm, signifying 'equal force'. It was notable that MBH arms were only ever designed to be compatible with MBH heads, and vice versa. Vic much preferred his own head socket, and factory adjustment for playing weight and tracking bias.

The important thing for Vic was that the basic MBH design performed well and attracted the support of professional users, largely by 'word of mouth' recommendation. To quote from his lecture, he said:

"Over 5000 were sold, many of them overseas. One quite good customer was EMI, both in Australia and at Hayes (UK) for their own use — including the checking of masters prior to production. The Indian Government bought over 1000."

Next month we'll continue the story with the age of stereo, commercial activities, and the fire that destroyed the MBH factory.

(To be continued.) ❖

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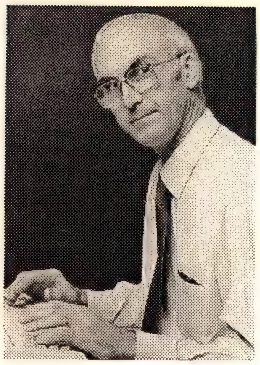

The project we developed, but legally can't tell you how to build...

I have something quite different for you this month: the story of a neat and useful little construction project that we developed, only to discover that we couldn't legally publish its construction details. I really should have realised this before we started, so it's an embarrassing admission. But at the same time I believe the story should be told, because of what it has revealed about the current *Telecommunication Act*, and its draconian and wide-ranging ramifications.

As long-time readers of these columns will know, every so often I deliberately inject a new topic in an effort to stop us from getting too bogged down in the same old arguments. That's exactly what I'm going to do this month, although introducing it this way might suggest — wrongly — that the decision was a purely arbitrary one. In reality it forced itself upon me, and in a particularly embarrassing way.

It all started about six or seven weeks ago (as I write), when project designer Graham Cattley and I sat down to decide what would be his next project. When we looked through our long list of 'asked for', 'really needed' and 'worth looking into' project ideas, there was one idea that we both liked. It was a device that we'd received many requests for: an off-hook detector/alarm for phones.

The basic idea was to produce a small, very low cost and self-contained unit which could sense when your phone had been off-hook for more than a certain time — say 15 or 30 minutes, and then produce both an audible and visible alarm, to bring the situation to your attention. This would have two uses: to warn you if you'd accidently replaced the handset incorrectly (which is fairly easy with some of the newer phones), and also to serve as a reminder when a phone call might be dragging on too long...

We decided that this unit would make a good project, particularly if it could be given a 'reset' button so that the alarm timer could be manually reset, if the user really needed to continue with an extended call. So Graham went away with this brief, and began the design and development process.

He's a pretty fast worker, and within a couple of days he had a rough prototype going on the bench. He'd come up with a very simple, elegant and low cost circuit, which turned out to be capable of doing everything needed for the job: it detected the off-hook condition very reliably, provided a choice of either a 15-minute or 30-minute time delay, and then produced a loud and very attention-getting 'alarm' sound — along with a flashing LED. All from a couple of low cost CMOS integrated circuits, a tiny piezo speaker and a handful of minor components, operating from a 9V battery.

It looked like an excellent little project, so Graham then went ahead with my approval and proceeded to design the final 'pretty' version to describe in the magazine. He produced a PCB design which allowed all of the parts to be mounted comfortably in one of the smallest plastic 'jiffy' boxes, with a couple of the 'modular' RJ11 sockets mounted directly on the board so that it could be connected simply and safely into the phone line.

The prototype was soon finished, and passed every test we gave it (on a variety of phone lines, and with a variety of phones, of various vintages) with flying colours. So Graham went ahead and wrote the article describing it for the magazine. In turn I gave the article my editorial once-over, the photos were taken and then production editor Mille Godden-Jones laid it all out ready for publication — in this issue.

But then the bombshell hit. A visitor to the office, shown the prototype in passing, expressed surprise that we were planning to publish the design. That'd be inciting readers to break the law, wouldn't it? Because we'd be encouraging them to build a piece of equipment designed specifically for direct connection to a telephone line — part of the PSTN (public switch telephone network)...

At that point I confess it really hadn't occurred to me that the Off-Hook Alarm might be illegal. Yes, it *was* designed to connect directly to the phone line; but it was fully self contained, and operated from a tiny 9V battery — there were no connections to other equipment, as with a modem, or or external sources of power. Besides, we'd taken considerable care to ensure that the phone line connections were made via standard connectors, mounted directly on the PCB to preclude the possibility of wiring errors. We'd also made sure that negligible current could pass between the phone line and the circuit, in either direction. It was about as safe as you could get, surely.

Why hadn't I twigged? I'm not sure, particularly as I have known for years now that we'd never be able to describe any more modems or similar projects in the magazine. Somehow I just hadn't realised that *this* project would be just as verboten as a modem, despite the apparent differences.

New Telecomms Act

Perhaps I should digress here, and give a brief recap. When the Federal Government passed its heavily updated and revised *Telecommunications Act 1989*, and set up the Australian Telecommunications Authority (Austel), it soon became clear that magazines like *EA* would no longer be able to describe designs for do-it-yourself projects like modems. Austel made this fairly clear in letters they sent to all of the magazines in the industry, drawing attention to the fact that equipment could henceforth only be connected legally to the PSTN providing

DINGALINGA, LINGLINGA!
AAOOGAH!
BEEP BEEP BEEP
BIP BIP

it was 'permitted' — i.e., had been subjected to the required testing, and issued with an Austel Permit. The penalty for connection of non-permitted equipment was set at $12,000.

The *Telecommunications Act* was further revised in 1991, as I recall, but things didn't change a great deal. Although Austel didn't send magazines like *EA* a copy of all the relevant rules and regulations, we gathered that the cost of the testing they'd require for any modems or other projects designed for connection to the PSTN would be many hundreds of dollars, and that even if *we* had our prototype tested and issued with a permit, readers who built one for themselves would still have to go through the same procedure — and pay the same testing fees (now much higher).

Needless to say there wouldn't be any point in telling people how to save money by building their own modem or whatever, if the price of getting their individual unit tested and 'permitted' would end up making it cost more than one they could buy off the shelf. Either that, or we'd be encouraging them to connect and use it illegally, and risk a fine of $12,000...

It all sounded rather hopeless, but in late 1992 I sent a letter to the General Manager of Austel's Compliance Branch, asking if there was any possible way in which the new regulations *would* allow us to describe this type of equipment, perhaps by having a prototype tested before publication, and then allowing reader's duplicate units to be given permits without costly testing. To this day I've never received a reply, and I imagine this is one of those cases where 'no news is bad news'. The only prudent assumption I could make is that Austel's answer was 'NO', and that's why we haven't described any modems of similar devices for the last few years.

But little battery operated, self-contained Off-Hook Alarms? It hadn't occurred to me that they'd be in the same boat.

Sought advice

Once my doubts about the project's legality were aroused, though, I had to make sure one way or the other. I rang an old friend of mine who has been heavily involved in getting things like phones, faxes, modems and answering machines tested for Austel permits, and explained the situation. At his request I also sent him details of our project, so he could consider it and refer to the relevant sections of the various rules and regulations.

The next day he rang and broke the bad news. True, our project wasn't like a modem or phone or similar device designed to communicate over the PSTN. But after carefully considering its use and construction, he was fairly sure that it too *would* need a permit before it could be legally connected to the PSTN. Worse still, though, he doubted that it would even be *capable* of passing the tests required for getting a permit — because when the battery had to be replaced, the box could be opened without disconnecting the unit from the phone line. So there was a possibility that the user could make contact with the internal circuitry, and hence that dangerous voltages could be induced into the PSTN!

Needless to say, this advice was more than enough to force me into 'canning' the project. Although we had already made quite an investment in it, I really had no option but to decide against publication. I simply couldn't take the risk that the magazine, myself and/or Graham might be fined $12,000 for encouraging our readers to break the law — let alone publish information that might well cause readers to be visited by the Federal Police, and themselves be fined $12,000.

It was all very disappointing — especially for Graham, having his elegant little project design consigned to oblivion. And it was also rather embarrassing for me personally, having to admit that I'd allowed significant time, effort and money to be invested in a project that couldn't be published because it was probably illegal for readers to build and use it — and that I *should* have realised this before we began.

I guess in other circumstances, it was the sort of thing that a magazine editor might quietly sweep under the carpet, hoping that one's superiors would never notice 'the project that never was'...

Why, then, have I taken this unusual and perhaps foolhardy step of hanging my embarrassing dirty linen out in public, for all to see?

Well, because following my friend's advice, I decided to find out more about the *Telecommunications Act* of 1989/1991, and exactly what its ramifications are for a magazine like *EA* and its readers. And the more I learned about the various rules and regulations, the more draconian and wide-ranging they turned out to be. Certainly they're much more so than I had personally suspected, and to an almost farcical degree — more like the laws you'd expect to find in a police state or authoritarian 'banana republic' than in a nominally democratic country such as Australia.

Frankly I'm sure very few readers of *EA* would realise just how draconian and wide-ranging these powers wielded by Austel really are. And *that's* why I've decided to air the subject here, despite the personally embarrassing admissions that were necessary in the foregoing preamble.

A can of worms...

Actually it's hard to know where to start, because when you start looking into the Telecommunications Acts and their ramifications, they turn out to be quite a can of worms. But let's give it a try.

Do you realise, for example, that if you're walking along the street with your Walkman or other portable radio, listening to a radio station broadcasting a 'talk back' programme where listeners call in via the PSTN, you are strictly breaking the law unless your *radio* has an Austel permit? As the law stands at present, your actions could bring the same $12,000 fine that applies for illegal connection of a non-permitted modem or our ill fated Off-Hook Alarm.

Another example: you are having problems with a repair organisation which has tried to charge you much more than they quoted you it would cost to repair your VCR, and now they won't return it unless you pay up. You ring them, but use one of those little induction pickups to allow your solicitor to listen in to the conversation via a small amplifier, from the next room. Do you realise that you are breaking the law, unless the pickup coil and amplifier have an Austel permit? If caught, you could be fined $12,000.

Here's the little project that started this look at the Telecommunications Act — an Off-Hook Alarm. We can't tell you how to build it, though...

A further example: Your old '286-based PC is connected to the phone line via an equally elderly 300b/s modem — which does have a permit. But you connect your PC to a home-built DSO adaptor like the ones we've described in the magazine, and use the setup to measure signals in another project you've built. Surely this is OK, because the only connection to the PSTN is via a permitted modem? No, strictly speaking you're breaking the law — because neither your PC, your DSO adaptor nor the circuit you're testing are permitted equipment, yet they're *connected to* the PSTN. You could again be fined $12,000.

Yet another example: You are connected to an old telephone exchange which uses pulse dialling, but you would like to be able to access your bank's computer which responds to DTMF tones. Your old pulse-dial phone can't produce them, so you make up a little battery-powered unit with a keypad, a DTMF generator chip and a small speaker to produce the required audio tones to feed into the phone's microphone when needed. Isn't that OK? No, again it's quite illegal because your little box doesn't have a permit; if caught, you're liable for the same $12,000 penalty.

How can all of these pieces of equipment be covered by the Austel regulations, when none of them would seem to be directly connected to the phone line? Simply because you don't *need* to be directly connected. The regulations are so wide-ranging that they cover almost every possibility — except perhaps for a couple of jam tins joined by a length of string.

Don't believe me? Think it all sounds too crazy? OK, let's look at a few specific chapters and verses...

First of all, the basic requirement that anything 'connected' to the PSTN must have a permit. Here's the relevant wording, in section 253 of the 1991 Act:

253. (1) A person must not knowingly or recklessly connect to a telecommunications network customer equipment in respect of which a permit for connection to a telecommunications network is not in force.

Penalty: $12,000.

(2) For the purposes of subsection (1), a permit for connection of customer equipment to a telecommunications network is taken to be in force if such a permit is in force in respect of customer equipment that is of the same type as the first-mentioned customer equipment.

(3) This section does not apply to customer equipment that is connected to a telecommunications network in such a way that it cannot be used for or in relation to the supply of telecommunications services supplied by a carrier.

OK, so that's our starting place. Nothing can be connected to the telecommunications network unless it has an official permit — or is 'of the same type' as another piece of equipment that *does* have an official permit (according to subsection (2)); or failing that, unless it 'cannot be used for, or in relation to, the supply of telecommunications services' (subsection (3)).

Questions, questions...

Now if you're like me, you'll already have a few questions. For example, what exactly does subsection (2) mean? Conceivably it *could* mean that a permit might be 'taken to be in force' for a home-made modem or Off-Hook Alarm, providing it was deemed to be 'of the same type' as a commercial unit that does have an official permit.

Well, the Act seeks to clarify the intended meaning of 'equipment of the same type' earlier on, in subsection 20 which reads:

20. An item of customer equipment is of the same type as another item of customer equipment if:

(a) the items were produced to specifications that differ in no material respect; and

(b) the respective ways in which the items were produced differ in no material respect; and

(c) the form and functions of the one item differ in no material respect from the form and functions of the other item.

There — doesn't that make it clearer? As I read it, everything seems to hang on someone's interpretation of 'no material respect'. But *that* could surely be taken to mean almost anything, from 'identical in all respects' to 'uses circuitry which performs in virtually the same way as'.

In other words, the exact interpretation of Section 253's subsection (2) is really left to the discretion of Austel, and it's pretty clear that *they* wouldn't want to interpret things in a way that would allow DIY modems or Off-Hook Alarms to be used as equipment having a 'deemed' permit.

Some modems not tested...

I have heard, though, that at least some of the low-cost imported modems on the market have NOT been tested for compliance with the various standards, but have snuck through because they can be shown to 'differ in no material respect' from other modems that *have* been tested and given a permit. Presumably this is because they're made in the same factory in Taiwan or Korea, and differ only in terms of the plastic case or brand name...

Another question that occurred to me, after reading Section 253's subsection (3), was the exact meaning of that phrase 'cannot be used for or in relation to the supply of telecommunications services'. This sounds pretty vague, leading to the possibility that our Off-Hook Alarm project just *might* be permissible, on the grounds that it can't be used to transmit or receive information via the network...

I haven't been able to find any further clarification of this phrase, so presumably it's again one where the exact interpretation is left to Austel's discretion. And of course Austel could easily argue that the function or purpose of almost *anything* connected to the network will at the very least be 'in relation to' to the supply of telecommunications services — quite apart from whether or not it can be 'used for' the supply of such services. After all, even our little Off-Hook Alarm has a function 'related to' the supply of telecommunications services: it tells you if your phone has been left off the hook, stopping you from receiving calls!

OK then, so far we can see that although Section 253 of the Act is as broad as a barn door, Austel has so much discretion in its interpretation that there's almost no possibility that any DIY project like a modem or Off-Hook Alarm could 'sneak through'. In fact it's pretty clear that nowadays we cannot publish details for virtually any piece of equipment that connects directly to the phone line — the risks of prosecution are simply too great, for either us or our readers or both.

No physical connection

But why did I refer earlier to things like a Walkman, an inductively coupled pickup and amplifier, a DSO adaptor connected to your PC, and a DTMF tone maker also needing a permit for legal use? Well, because when you look a little further into the Act, you find that permits aren't just required for equipment that is directly connected to Telecom or Austel lines. It turns out that virtually anything that couples information into or out of 'the network' requires a permit.

Don't believe me? Here's the definition concerned, given in Section 17 of the Act:

17. Equipment, or a line or other facility, is connected to a telecommunications network if the equipment, line or other facility (either by itself or in conjunction with any other thing) is being used to supply, or is installed or connected for use to supply, telecommunications services by means of the network, whether or not the equipment, line or other facility is comprised in, or is in physical contact with any part of, the network.

Did you notice that last bit, about not having to be in physical contact with any part of the network? The implications of this start to become even clearer, when we look at the definitions given earlier in Section 5 of the Act, for the meanings of 'telecommunications network' and 'telecommunications service':

"telecommunications network" means a system, or series of systems,

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for carrying communications by means of guided or unguided electromagnetic energy or both;

"telecommunications service" means a service for carrying communications by means of guided or unguided electromagnetic energy or both;

Starting to get the idea? ANY piece of equipment that is effectively linked to the telecommunications network by means of electromagnetic energy, is deemed to be 'connected to' it. And no consumer equipment can be legally connected to the network unless it has a permit.

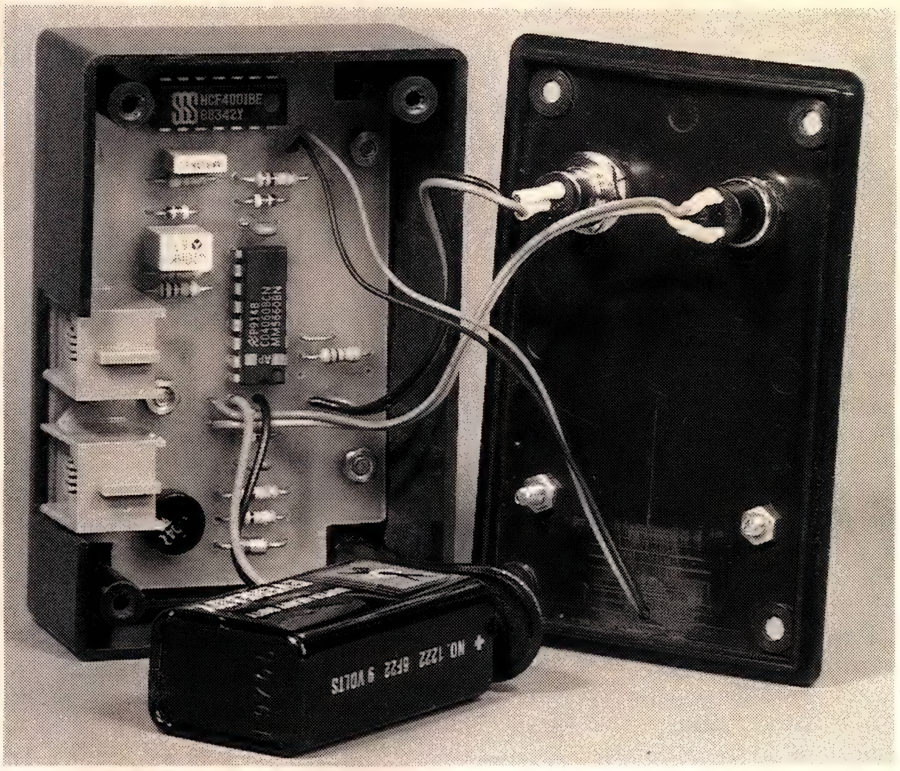
So if you're using your Walkman to listen to a 'talk-back' radio program — or a program that's being sent from the studio to the transmitter via a leased line or ISDN link — your Walkman is connected to the telecommunications network. If it doesn't have an Austel permit, you're breaking the law and could be fined $12,000.

Similarly an induction-based pickup coil and any amplifier connected to it are clearly connected to the network via electromagnetic energy, so they too can't be used legally unless they have an Austel permit. (Actually in this case you'd also be breaking the law twice, because the induction pickup is a 'bugging device' and therefore forbidden by the Telecommunications (Interceptions) Act.)

And even though the modem which connects your computer to the network may be permitted, your computer itself clearly also needs to be permitted — along with any DSO adaptor or other peripherals connected to it, and anything else you may connect to them. Otherwise they're ALL illegal, and using them renders you liable for that familiar $12,000 fine.

Probably the only one of my earlier examples where there exists any real doubt is that home-brew DTMF tone maker, which is coupled into the network via sound rather than electromagnetic energy. Although even here, Austel would probably be able to use its discretion to rule that since information is being communicated to the network, the tone maker is effectively connected to it. After all, they presumably use this kind of definition to back up their demand that an acoustically-coupled modem must have a permit.

If the truth's known, they can probably demand that your kids get a permit for their two jam tins joined by a piece of string — if there's any risk that some of the sounds transmitted could be picked up by your phone!



A view of the inside of our ill fated Off-Hook Alarm project. We can't tell you how to build it, because using it would be illegal — risking a fine of $12,000.

Crazy situation

Seriously though, aren't you just a bit surprised at how wide-ranging the Telecommunications Act really is? In theory, just about anything electronic that's even remotely or indirectly linked with a phone line is deemed to be 'connected' to it, and therefore needs an Austel permit to be used — if you are to avoid breaking the law, and becoming liable for that draconian $12,000 fine.

I think you'll agree that it's a pretty crazy situation. Here we have a law that's so all-embracing that it's almost farcical, as well as being in practice impossible to police.

Yes, it's probably true that the people in Austel charged with applying the rules and regulations based on the Telecommunications Act 'use their discretion' to apply them fairly sensibly to only the equipment that really does need to be tested for an official permit. But any law that needs this kind of discretionary interpretation and application before it can be made to work is surely a very bad and dangerous law — because it leaves the door open for corruption and abuse.

That's why I'm making a bit of a song and dance about it. Not because we had to kill our little Off-Hook Alarm project; it goes without saying that I'm to blame for that one. I should have realised before we started that it was illegal, because of its direct electrical connection to the phone line.

No, my real worry is that in their attempt to produce a new Telecommunications Act which would cover the rapidly-changing era of multi-carrier, fixed and mobile and personal telecommunications, our legislators seem to have produced a monster: an Act which is so wide-ranging that it can only be made to work in practice by relying on the discretion of Austel's bureaucrats. Doesn't that worry *you*, too?

At the very least, it casts a shadow over the legal ability of magazines like *EA* to describe (and readers to legally build and use), a whole raft of build-it-yourself projects. Not just things like modems and Off-Hook Alarms, but even equipment like computer peripherals, interfaces and attachments. And yes, theoretically even radio receivers and amplifiers.

But what do YOU think? Don't just sit back and let me rave on about it. Let me know what you think. If enough people make it clear that they find the current Telecommunication Act a bit over the top, something *might* be done to replace that barn door with one of more sensible dimensions...

And that's all for this month. See you here in the Forum next time, I hope. ❖

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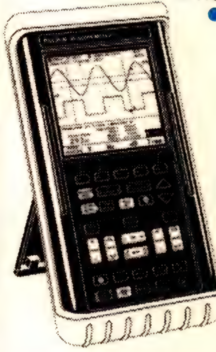

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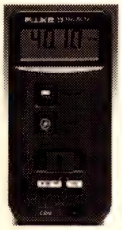

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THE SERVICEMAN

The sinister case of the 'exploding' microwave ovens...

As promised, we have a collection of short stories from contributors for you this month. There's one about the hassles of designing a microwave intruder sensor, another about a weird fault in a colour TV set which would 'wander off' to sample another channel, and yet another about a VCR which turned out to have an incredibly unlikely combination of faulty components. Just for good measure we have some more information on car generators which spontaneously reverse their polarity, and finally a worrying story about two microwave ovens which 'exploded' quite dramatically...

Last month I promised you a medley of stories from our contributors. Most of these are in the order of 500 words long, so we might get six or seven of them in before I run out of space. Here we go, then...

First up comes one of those rather technical stories from Alan Leitch. This time it's an alarm system story, and it just might solve some of *your* false alarm problems!

Microwave intruder detectors are prone to false alarms generated by the motion of the ionised gas molecules in an operating fluorescent tube, unless special precautions are taken in the design of the signal processing circuits.

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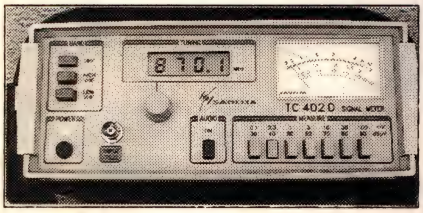

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READER INFO NO. 13

Each time the polarity of the AC mains reverses, the direction of travel of the gas ions also reverses, producing a 100Hz doppler component. Then assymetries in the ionisation potentials of fluorescent tubes in multiple fittings produces a 50Hz doppler signal.

The usual method of eliminating this interference is to include a 30Hz low-pass filter in the signal path, but this has the undesirable effect of limiting the response of the detector to moving targets with a velocity of less than 1 metre/sec. It also removes the higher doppler frequencies characteristic of human movement, such as those due to arm and leg motion.

Initial attempts to eliminate the 50Hz and 100Hz components with notch filters were not particularly successful, due to the broad spectrum of the interference. The deeper the notch the narrower the stop band became, and the more critical matching of components for tolerance and temperature tracking made this approach impractical.

What was needed was a tuneable filter, with adjustable bandwidth and infinite attenuation in the stop band. One of our engineers came up with a brilliant and simple solution.

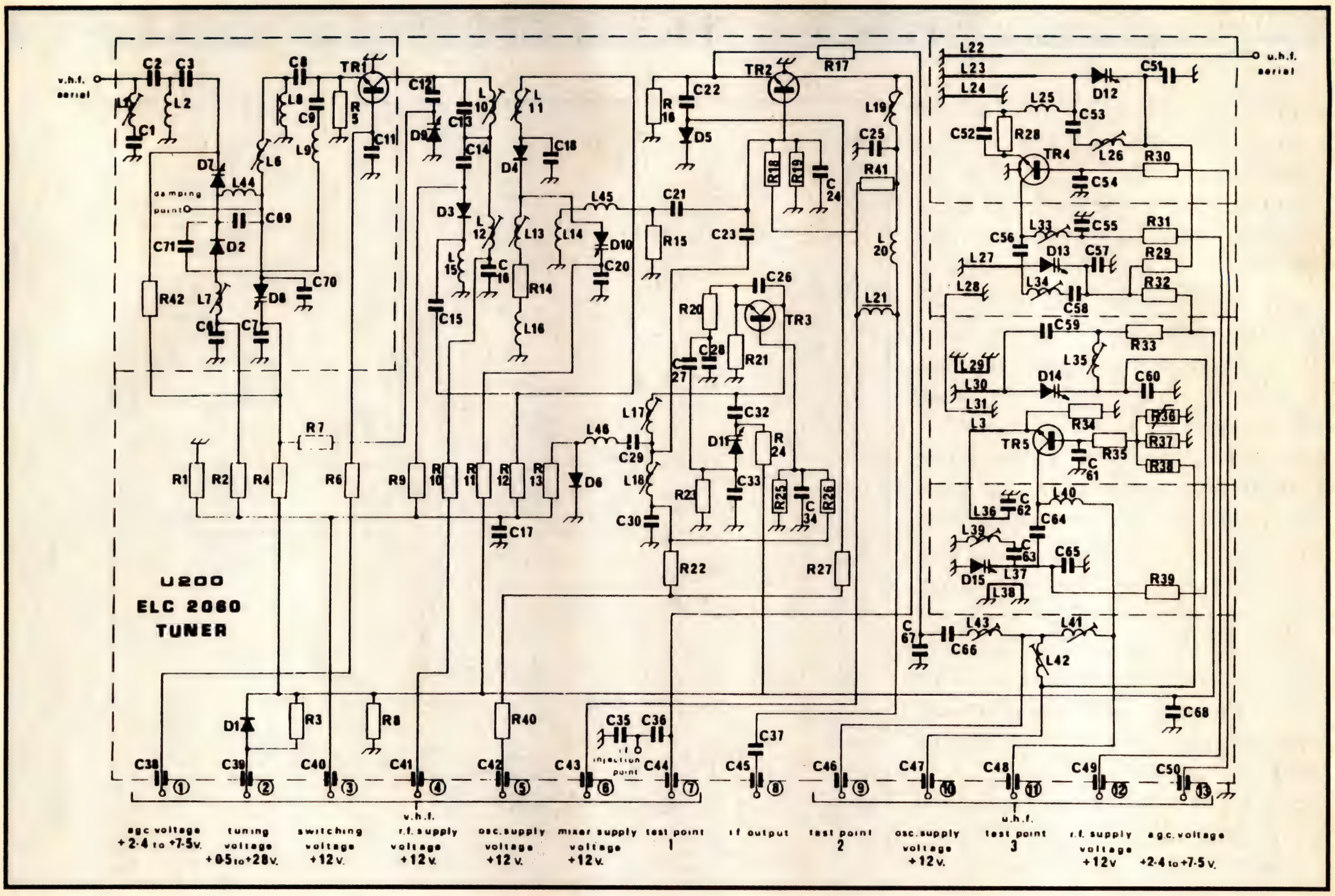
He suggested that we roll the response of the analog section off at 150Hz, detect all signals above a preset level with a Schmitt trigger and differentiate these pulses. When the Schmitt fires, start a pair of non-retriggerable one shots which in turn produce a pair of blanking pulses, delayed so that if a differentiated pulse occurs either 10ms or 20ms after the Schmitt fires, it will be negated.

This produced a system response with an overall passband of 150Hz with stop bands at 50 and 100Hz. Adjusting the delays sets the upper bandstop frequencies and adjusting the blanking pulse width sets the bandstop bandwidth.

If the only source of doppler signals is that due to the fluorescent tubes, this circuit synchronises to these frequencies and all differentiated pulses are cancelled. When an intruder enters the detection field, differentiated pulses which fall outside the blanking periods are generated and these are integrated until the alarm trip point is reached.

This system proved to be very effective. In fact, it was so good that a microwave detector could be mounted within two metres of a fluorescent fitting yet still detect an intruder 30 metres away without false alarms from the fluoro.

Well, I don't know, Alan. That certainly sounds like a clever way to solve a real problem, but unless the circuitry is turned into an IC and sold by Dick Smith or Tandy, I can't see it helping ordinary folk like us. Then again, are there that many microwave alarm sys-



This is the circuit for an older style Philips ELC2060 VHF/UHF varicap tuner module. The modern miniature tuner discussed in Doug Thwaites' story uses substantially the same circuitry, but with surface mount parts in a much smaller case.

tems in use? I suspect that there are many more passive IR systems about. What do readers think?

Thanks anyway, Alan. We'll be hearing from you again, I'm sure.

'Big is beautiful'

Now for a story from someone we haven't heard from for some time. It comes from Doug Thwaites, from Esk in Queensland. Doug has a few words to say about something that I've puzzled over many times recently. Here is his story...

I am sure that I am not the only serviceman who gets more out of some jobs than just the money. If I find a very elusive fault and finally give new life back to a piece of equipment, I still get a kick out of it after many years in the business — pride, possibly. I will now tell of one I met lately, which I'm calling BIG IS BEAUTIFUL.

The local caravan park has a number of small TVs that they hire out, and one was brought to me with a weird fault. It has a tuning system where buttons were pressed for the allocated station, but after a while it would change stations of its own accord. This would happen for a few seconds, then it would settle down on the original station for a few minutes and then go off again.

It was an AWA C3409, using a 'Q' chassis. There is not much room to work around the pushbutton assembly and the panel with the presets for tuning. I got the circuit diagram out and that is where the trouble started, because according to the map the panels were not connected correctly. But as the TV worked perfectly when it settled, I knew that could not be right...

A little examination of the circuit shows that indeed it is drawn incorrectly, in that the two wires from the button panel are transposed — a lot of help that was! It turned out to be a standard system using a DC voltage from a zener to a series of slider resistors on a panel.

Using the CRO, I soon saw that the voltage out on pin 2 of cable RF to the main PCB was jumping all over the place when the fault occurred. The voltage in from the zener was rock steady and the 1.5k resistor that feeds this voltage to the pots was 100%, so I turned to the main PCB.

The voltage on pin 2 goes to the tuner via two resistors and a decoupling capacitor, which I suspected at once and replaced. The two resistors tested OK, but to my dismay the fault was still there. It just had to be inside the tuner.

This is one of those little tin boxes well soldered on the PCB, but I got one side off and was horrified to see all the tiny SMDs crammed in there. I once tried to change SMD transistors without success, and they are a No-No with me. I reported the bad news to the owner, who told me to scrap the set or keep it for parts. So I just put it aside. Many months later when I was having a cleanout, I came across it again and *thought what a shame it could not be repaired as it had a perfect picture when working.*

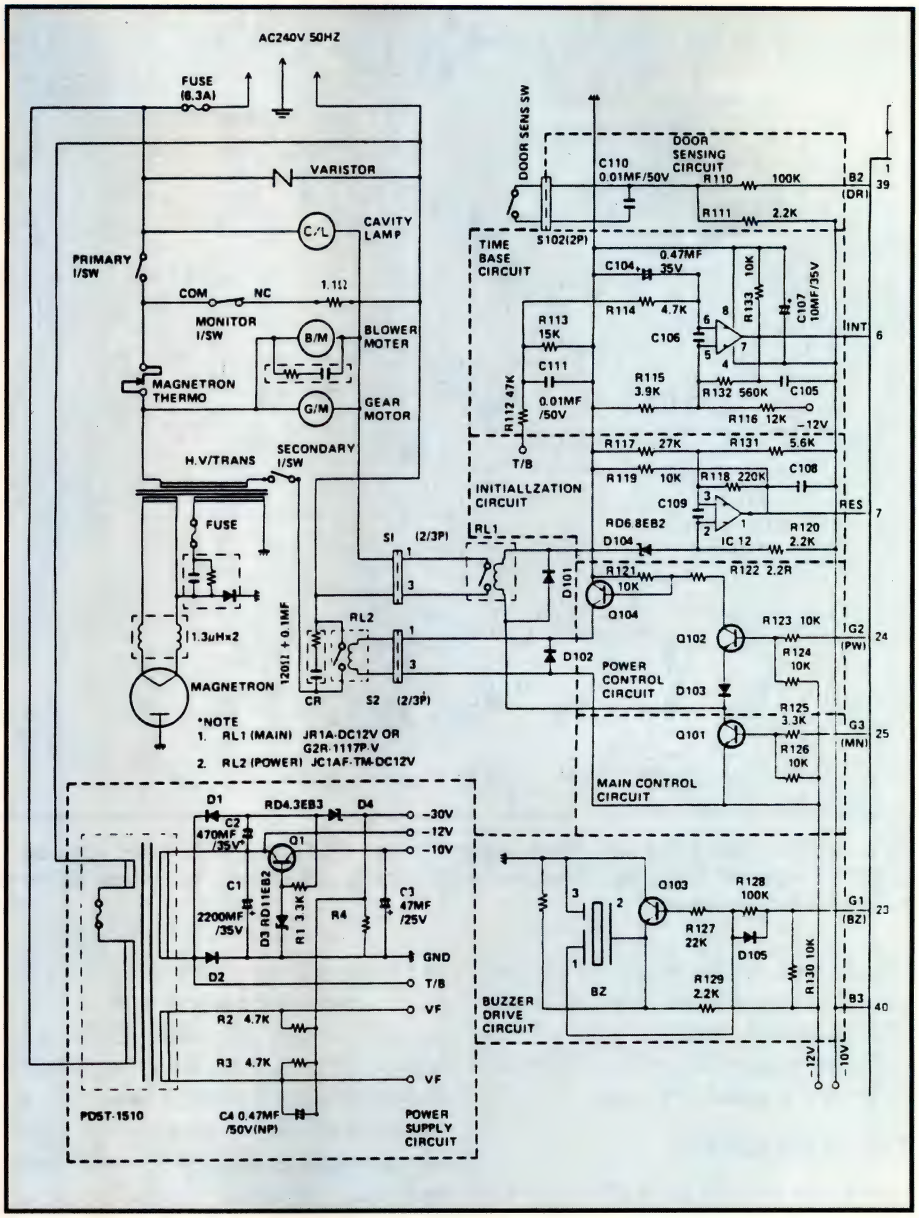
So I unsoldered the tuner and got it out on the bench, then fed DC through a 10k resistor to the TV pin and ground (the case). Using the CRO once again there were the variations of the voltage on TV. Putting on my magnifying glasses, which fit with a headband I examined the tuner.

I could see that there was a section for UHF and one for VHF, also the local oscillator in a screened-off corner. I examined the copper track that ran from the TV pin and found no less than seven resistors, leading in all cases to SMD varicaps. I was about to check the voltage variations across each of these varicaps when I noticed a small green lump at the end of the copper land in the UHF section.

It was just over 3mm in diameter. I got the soldering iron with the fine tip and using tweezers got it out — and there it was, a ceramic capacitor marked 102 which from the code stood for a 1nF or '.001uF'.

Fitting in a normal sized cap with care, I put it all back together and the TV has been running for some weeks without a sign of trouble. I did get a kick out of that I must admit, but as I said before — big is beautiful, where SMDs are concerned.

My reasoning behind the fact that it moved on to another station and stayed for there for a time, is that as the voltage varied into another station's range the AFC would pull the station in and hold it as long as it could.



Part of the circuit for a typical microwave oven. The varistor, visible near the top, is wired permanently across the mains with only the 6.3A fuse in series. If it is going to fail for any reason, there is ample energy available to make its departure quite spectacular!

As much as I admire Doug's tenacity in trying to repair a miniature tuner, I wonder why he didn't suggest a replacement tuner to the original owner. These are now quite cheap (well, around $30 cheap) from a number of distributors, and this makes repairing them quite uneconomical.

Indeed, when I hark back to the early days of Philips type tuners which cost an arm and two legs, I am astounded at the tiny cost of these Korean type minituners. I used to go to great lengths to try a repair, until I realised just how cheap a replacement was...

Anyway, Doug has got himself a nice little television (and a fee for telling us his story). Thanks, Doug.

Nasty hiccups

Now we move on to a story from Graham Smith, of Lindfield in NSW. He presents a story about a Panasonic VCR with about as bad a case of electronic indigestion as any I've heard. I don't know if I would have had the patience to sort this one out. See what you think...

I've worked with VCRs on an occasional basis for two years. Compared to other jobs that challenge me, I've found VCRs most often need mechanical attention, especially belts and tyres. But this job was different.

With the holidays approaching, a Panasonic NVG20 VCR was offered with the complaint that it wouldn't record. For a week prior to the unit *being delivered I pondered what nasty control problem there might be — or worse, what signal path might have failed. Bear in mind I don't have a manual for this model.*

With the unit on the bench and cover off, I found a stuck cassette. This did not fit the description of 'won't record'. Turning on power produced audible hiccuping from the power supply and nil operation, with no front panel activity.

This was fine by me! I happen to have a fascination for switching power supplies and have repaired many. It's my speciality. It took only a few minutes to remove the power supply module and confirm that it demonstrated similar symptoms without any external load.

A call to the customer revealed that after packing the unit for transport it had been plugged in again to remove a tape, but then it didn't work at all. I was relieved that the customer had witnessed the total failure, rather than me later having to convince them of the fact.

The outputs from the power supply seemed rather odd. What should have been about -30V measured -80V, yet other positive outputs were very low! This made me speculate that the main power switcher STR10006 must be cutting off very short, leading to gross flyback pulses in the transformer.

I found no fault with the damper network on the primary, but not knowing the precise internals of the STR10006, I set about eliminating all other resistors, diodes and transistors on both primary and secondary sides. Next I checked the remaining high stress caps on the primary, and found them all good. As a last step I checked two inconspicuous 47uF 16V electros. These both measured about 1uF...

With these two caps replaced the hiccuping was gone, but with the power supply connected into the VCR, there was still no activity and no timer. Now I worried about the previously observed -80V, since it goes directly to the timer microprocessor, an expensive custom number.

After despairing of the possible fate of the timer micro, I was eventually led to check all the power supply outputs, this time with a scope. Here I found one that diverged radically from a straight line.

While some timers use an AC signal, this wasn't one of them. I confirmed this by opening the power supply and finding a soft electro, this time a 47uF 50V. Since now I was holding faulty electros from plainly different batches, I wondered: what other caps were low?

After progressively removing and testing each electro, the answer was ALL TEN OF THEM. Most of these measured grossly low. These were all 105° units, too! It was remarkable that this VCR worked at all, at any time recently. I've often read of caps that misbehave, but have never had to comprehensively replace every last one in a module. It's usually just the one or two.

With that done, the unit was restored to full operation (apart from the time spent realigning the gears on the loader, quite different from any other NV-G that I have worked on). And yes, it did record too!

As Graham said at the start, most VCR faults are mechanical. The chances of finding an electrical fault such as described here must be astronomical.

It's not at all unusual to find low value (1.0, 2.2, 4.7uF etc) electros showing low capacity or open circuit. This is so well known as to need no comment. But in Graham's story there were much larger values (47uF) that had failed, and this IS unusual. But then, all ten in one module? There must have been a reason, though I can't imagine what it was.

Thanks Graham. We'll have more from you another time.

Mind of their own

Now we come back to the subject that will not go away — car generators! This one comes from a new contributor, who seems to know as much about the subject as anyone to date.

He is Stan Allison, of Rosebud, Victoria. Stan obviously has a lot of experience with polarity changeovers, and for the very reason suggested earlier — to accommodate modern negative earthed electronics into older, positive earthed vehicles.

Here's what Stan has to say:

I have also had experience with auto generators reverting to their manufactured polarity, after having had a polarity reversal in service. The usual reason for the change is the installation of an earth negative radio in a vehicle having an earth positive electrical system.

The easiest way to effect the polarity change is to reverse the battery connections, swap over the ammeter leads, if any, then hold the reverse current relay contacts closed while someone starts the engine and revs it briefly.

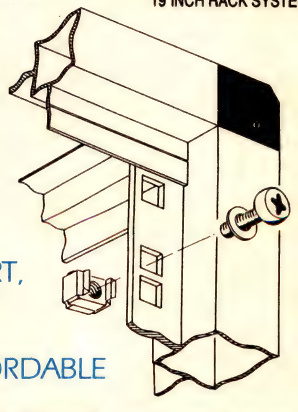
However, on rare occasions a generator will revert to its original polarity on the next or subsequent startup. In such instances, a permanent polarity reversal can be achieved as follows:

Reverse the polarity as above, but don't stop the engine. Let it idle. Then slip a piece of insulation between the reverse current contacts to prevent them closing. Bridge the voltage regulator and current regulator contacts and then rev the engine for a couple of seconds.

This causes the open circuit generator voltage to rise to 50-90 volts. This in turn deeply saturates the field iron in the desired magnetic direction. Thereafter, the generator builds up with the desired polarity.

Commutator and brush sparking can be dramatic during this process, but no real harm will occur in the one or two seconds of over-voltage.

However, something must be said about the iron used in generator carcasses. The barrel of a 12 volt generator is usually made of a malleable iron, but



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the poles are made of harder and sometimes quite brittle material. These pole pieces will retain a fairly high degree of residual magnetism but this can be reversed in obstinate cases as described above. This relatively high residual magnetism is necessary on 12 volt systems to generate a sufficiently high startup voltage to overcome the brush/commutator resistance, and so excite the machine to working voltage.

Incidentally, the voltage drop between commutator and brush is substantially constant, regardless of current flow (a spark phenomenon).

Finally, another, but less convenient method of reversing a generator's polarity is to physically swap over the North and South pole pieces.

So there you are! How to change the polarity of an auto generator quickly, simply and permanently. Thanks, Stan.

Actually, Stan's story adds to one told here a couple of months back. A contributor made reference to a generator pole piece retaining a higher than expected residual magnetism and now Stan Allison has offered a logical explanation. Thanks again, Stan.

Well, I think we have had enough about auto electrics for now. It's an interesting subject for those who like to potter with older vehicles, but the time has come to move on to other things.

Microwave explosions

And we go to another new contributor, Greg Johnson from Cooma in NSW. Greg's story is really a warning about a danger that has had no publicity to my knowledge. Read his story first...

These days there are usually adequate warnings printed in articles, leaflets, service literature etc about the dangers of microwave ovens. We have all read of the perils of microwave leakage, the lethal capacity of the power supply, etc. But there appears to be very little written about other hidden dangers to service personnel.

This story began one morning when a flustered looking woman entered the shop, followed by a timid little man struggling under the weight of a larger than usual microwave. We wasted no time in getting the monster on the bench and as the husband breathed a sigh of relief to be free of his burden, the lady of the house proceeded to tell the story of what had happened.

"It vas vorking ze night before, vor teatime, but ven I vanted to use it dis mornink it is kaput!" she explained, in an accent thick enough to cut.

After they had left, I removed the cover and checked the fuse, which was blown. I went over all the usual causes — high voltage diode, capacitor, burn marks on the transformer etc. — and having found nothing, I replaced the fuse and switched on.

It came up OK, but after a few seconds there was a loud report followed by a shower of sparks flying all around me. This did nothing to instil confidence in my abilities, with the people who had just then entered the shop.

I returned to the bench, adamant that I would find the cause of such a spectacular display, and began to delve gingerly into the innards of the beast. I removed the microprocessor board for a closer examination — and there, half hidden by the power transformer, was the cause of my worries. It was one of those notorious varistors, fitted by manufacturers as protection against voltage surges. This one had a hole burnt right through the middle.

Later, I learned from the customer that the night before there had been a heavy thunderstorm in the area. I can only assume that a massive surge, probably due to the storm, had caused the varistor to carbonise and had taken out the fuse at the same time. When I restored the fuse and applied power, it went up like an arc lamp with all the noise and sparks mentioned earlier.

I assumed that this would be an isolated incident, so I replaced the varistor and returned the oven to the owner. But it was not to be. Two days later another oven arrived for service with a similar fault description.

Not to be caught out again, I removed the cover, went about all the usual checks and replaced the fuse when no faulty components revealed themselves.

I began a search for the varistor as the circuit gave no clue as to its location. My searches were to no avail and, telling myself that this oven probably didn't have a varistor, I applied power to the beast and stepped back.

You've guessed it. There was a loud report, followed by a stinging sensation in my left earlobe. When I examined the offended appendage in the mirror, I found a deep scratch that was weeping blood. After cleaning the battle scar, I recommenced the struggle with the oven in order to find that vengeful sod of a varistor.

Eventually, I found the device hidden in the wiring, enclosed in what I can only describe as a piece of plastic tubing, heat sealed at both ends. This one had exploded with enough force to penetrate the plastic tubing and radiate shrapnel in all directions. The piece that hit my ear could as easily have hit my eye, doing far more damage than a bloody scratch!

Maybe some of the people who service microwave ovens in lightning-prone areas of Australia have encountered this problem before, and are fully aware of the danger. This article is for the benefit of those who have not had the experience, and thereby run the risk of serious injury.

Thanks for that warning Greg. I'm sure that there are many who service microwaves that will heed your words.

I have known varistors to go out with a noisy "Phutt" but I can't say I've ever had one explode with sufficient violence as to scatter shrapnel around the workshop! That's a danger I could well do without and I think most of us would feel the same way.

Thanks, Greg. We look forward to hearing from you again.

And that's the end of this month's column. I didn't quite get to the six or seven contributors promised at the start. However five contributors, three of them new to these columns, is the kind of record that I hope we can repeat some day soon. ◆

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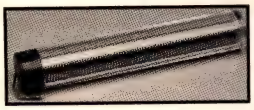

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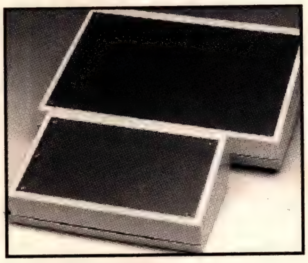

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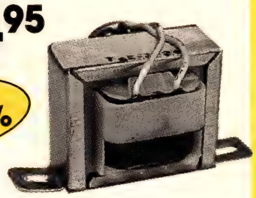

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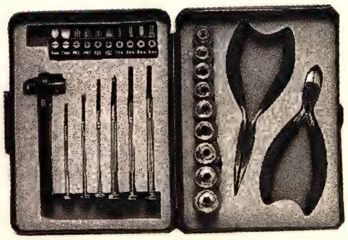

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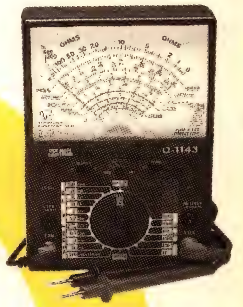

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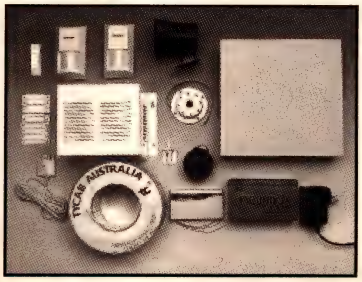

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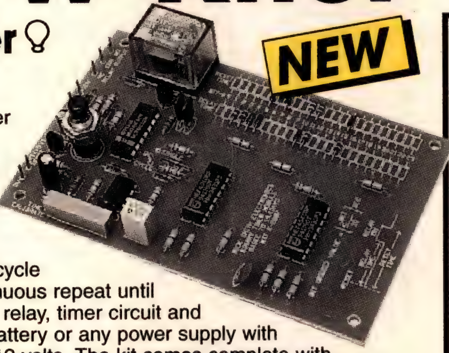
NEW



A handy low-cost timer that can be programmed for a total cycle time between 0.1 sec and 19.4 days. It can be programmed and configured for single cycle operation or for continuous repeat until reset. Consisting of a relay, timer circuit and diodes, it runs on a battery or any power supply with a voltage range of 9-12 volts. The kit comes complete with silk-screened solder-masked PCB, components and relay.

Cat K-2807

DISCOVERY SERIES

$24.95

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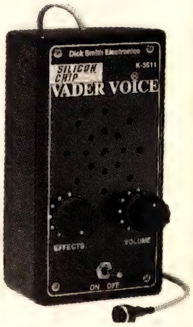
Vader Voice Kit



Here's one for Trekkies and Star Wars fans! It lets you disguise your voice as Darth Vader's (Star Wars) and Cylon's (Star Trek)! The main unit is housed in a small zippy box complete with volume, effect rate adjustment and on/off controls, while the microphone is connected via shielded cable. Easy to assemble, the kit comes complete with all components, PCB, hardware, case, speaker and front panel label.

Cat K-3511

SILICON CHIP September '95 **$29.95**

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Based on the highly versatile LM317T three terminal voltage regulator IC, this kit performs as a general purpose regulated power supply. Attach it to 240V mains (via a transformer) or a cigarette lighter socket and use it as a battery substitute! With built-in current and overload protection, it can be configured as any one of four power supplies: Fixed or variable voltage regulator, voltage regulator with programmable current limiting, combined voltage/current limiting (eg. for lead/acid battery charging) or constant current source (eg for NiCad battery charging). It comes complete with all components and silk screened, solder masked PCB.

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EA August '95

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Cat K-5406

$69.95

EA May '95

SAVE $20

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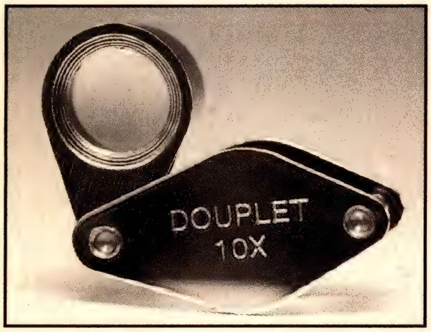

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Sensitivity - **(nom. 12dB SINAD)**	**0.3 - 0.5uV N.FM** **1.2 - 2.5uV W.FM** **0.4uV AM**
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Cat D-2730

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B 2103

DSE 'Discovery Series' Construction Project:

MULTI-TIMER MODULE

Latest release in the Discovery Series of learning kit projects from Dick Smith Electronics is this programmable timer module, which can be set to provide cycle times from less than a second up to over 19 days. The time before relay operation and the time that the relay remains energised are independently programmable, using diodes, and the timer can be used for both single-cycle timing and continuous cycling. The kit for the module is available from DSE's stores as Cat. No. K-2807, priced at $24.95.

This project consists of a relay driven by a timer circuit which is programmed by connecting diodes in certain positions. Following a reset pulse from a pushbutton or external source, the relay operates after a programmed delay period and then remains energised for a separately programmed period, before releasing. The circuit can be configured to operate for a single cycle as just described, or to continuously repeat the cycle until reset.

The total cycle time can be programmed from 0.1sec to 19.4 days, with a programming resolution, for both the operate and release times, of 0.1sec over the whole range. The reference clock uses a an astable oscillator with a high stability resistance-capacitance (RC) time reference, which is calibrated by means of a multiturn trimpot. Temperature drift on the prototype was found to be 0.05% over a temperature range of 20-40°C.

Operation of the circuit is entirely binary, with no binary to sexagesimal (sec, min, hours) conversion circuitry. This means that the programming is done by converting the required time to seconds, and then converting this decimal number to binary using the formula or conversion table provided. Diodes are then inserted on the PCB to correspond to every bit of the binary time which needs to be set for a '1'.

If frequent reprogramming is required, a simple modification is shown in the instructions for using DIP switches mounted on a separate PCB, rather than changing the programming diodes (the DIP switches and extra PCB are not supplied with the kit).

The circuit operates from a battery or any power supply within the range 9-12V, and takes only 4mA during the delay period and 50mA when the relay is energised. The power supply is regulated, to ensure good oscillator stability with varying supply voltages.

Construction

The complete timer is mounted on a single printed circuit board (PCB), measuring 103 x 75mm. For those who want to use the DIP switch modification, an extra PCB is required which can be made simply from a piece of Vero or Versa strip board; this will be described later. To fit the components to the board, refer to the photos and the overlay diagram, which shows where the location and orientation of all components. Read the label of the component, e.g. C1, from the overlay and then look up the description next to that label in the parts list. For example, C1 is an MKT type of capacitor with the value 0.47uF; it may be marked either 470n or 0.47u (470nF = 0.47uF).

One of the component types used is actually a substitute for a wire link. It has the appearance of a 0.25W 5% carbon resistor but has a nominal 0 ohm resistance, and on the overlay it is shown as a resistor with the label R0. These are used in place of permanent wire links, because they are easier to install than wire links and make the board look tidier.

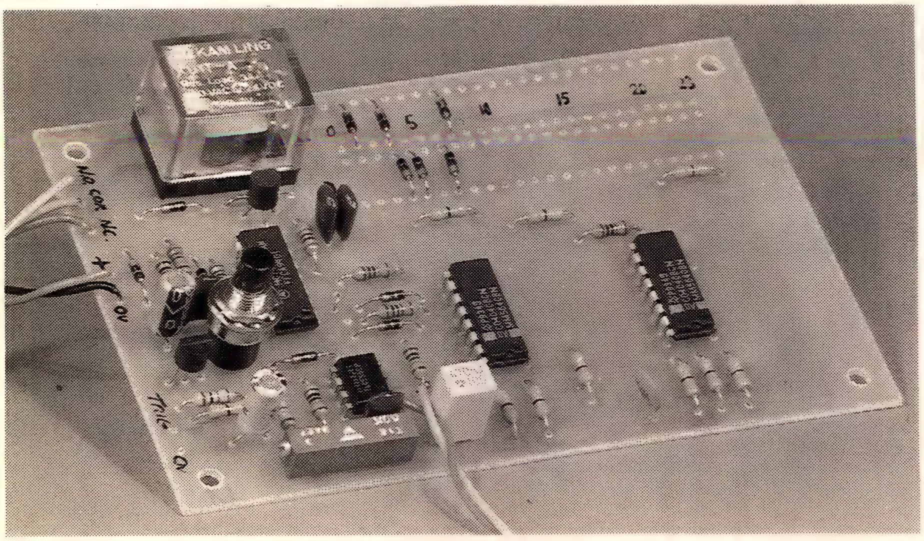
Begin construction by mounting the links and resistors R0-11. To find the resistor you want, a table has been provided which shows the colour code for each value. The last band of the colour code gives the tolerance value and is the one that is spaced further from the others. Resistors can be mounted in either direction, but it is good practice to mount them with their colour codes all in the same direction for ease of reading the values.

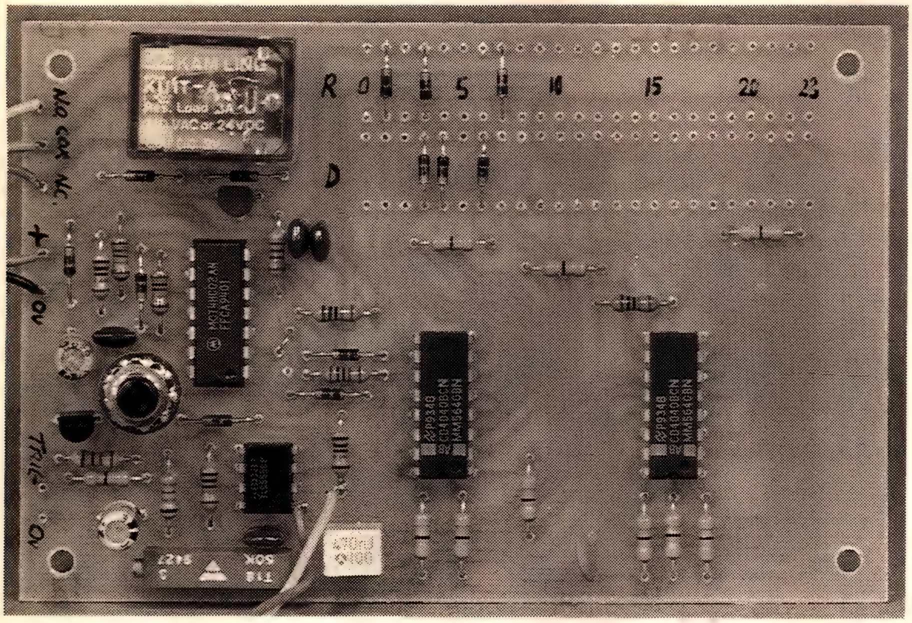
Next mount the diodes D1-7. These *must* be mounted in a particular direction only, with the stripe on the very end of the diode corresponding to the position shown in the overlay diagram.

If a DIP switch programming board is going to be made, all 48 of the programming diodes will be installed on a separate PCB.

Without a DIP switch programming board, the diodes are mounted on the main PCB, but the only diodes needed are those which correspond to the desired timing periods, after the binary timing is worked out.

A further alternative to mounting the





A close up view of the timer board, showing where everything goes. The programming diodes are fitted in the two rows at upper right.

timing diodes directly on the board, and to using the DIP switch add-on board, is to mount snap-off pin headers (DSE Cat. No. P-2726 or P-2728) in place of the diodes and solder the diodes to the pins. Do not repeatedly solder and desolder the timing diodes directly to the PCB, or the tracks will start to lift off.

Next mount the integrated circuits IC1-5. The ICs have a notch at one end, which in each case goes at the end shown on the overlay diagram.

CAUTION: ICs 1-4 are CMOS types which are sensitive to static electricity. Note the following precautions:

- Do not remove them from their protective foam until you are ready to install them.
- Avoid touching the pins with your fingers.
- Make sure that your soldering iron is properly earthed.
- Solder the power and earth pins to the board first.

Now mount the capacitors, C1-8. One thing to note when identifying a capacitor is that the value can be marked on it in different ways, for example 103, 10n and .01 are all the same value and are shortened notations of 10000pF, 10nF and 0.01uF respectively.

Capacitors C1-6 are non-polarised types which can be mounted in either direction, but C7 and C8 are polar electrolytics which will have a negative (-) or (+) sign marked on them and must be mounted in the direction shown on the overlay.

Next mount transistor Q1. Position it so that the flat side is facing the direction shown on the overlay. Do not press it down too hard into the PCB as this strains the leads and can damage its internal connections.

Lastly, mount the multiturn trimpot VR1 and the relay RL1.

With the assembly of the board complete, carefully check all the soldering. Look especially for dry solder joints, and solder bridges shorting the tracks together.

DIP switch board

A diagram has been provided which shows how the DIP switches and diodes can be mounted on a piece of Veroboard or Versa strip board, to make a more convenient programming panel for the timer.

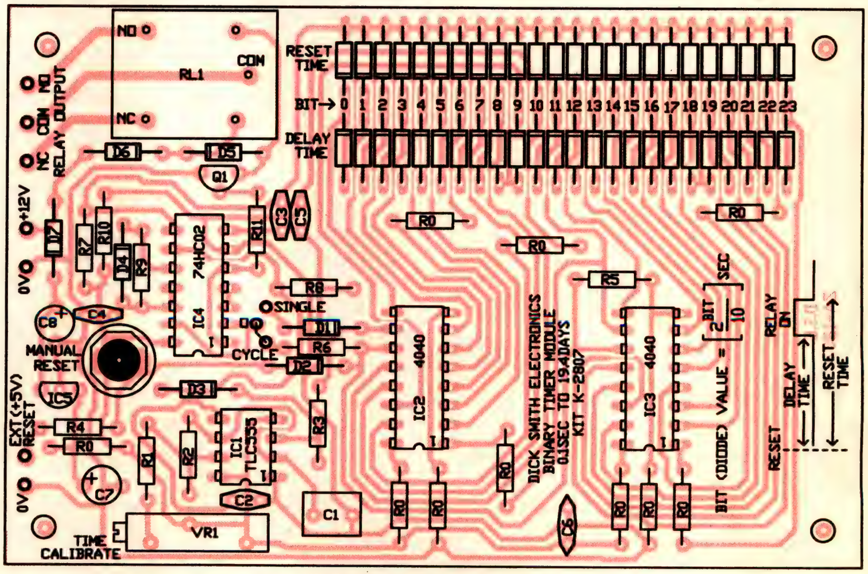
To construct this board, mount all 48 programming diodes in the direction shown and then mount the eight-way DIP switches. After the components are soldered, cut the tracks between the legs of the diodes and through the centre of the DIP switches as shown. The two PCBs can then be connected using ribbon or rainbow cable. Setting the switches to ON is then equivalent to inserting a diode on the main PCB.

How it works

The time reference for the circuit is an astable oscillator using IC1, a CMOS 555 timer IC. The oscillator works as follows. Assuming that capacitor C1 is initially discharged, the trigger (TRI) input of IC1 sees a voltage less than Vcc/3 (Vcc here is +5V), which causes the output (Vo) to go high (Vo = Vcc) and the discharge (DIS) pin to go open circuit. In this state C1 begins to charge, via the time calibration trimpot VR1 and resistors R1 and R2.

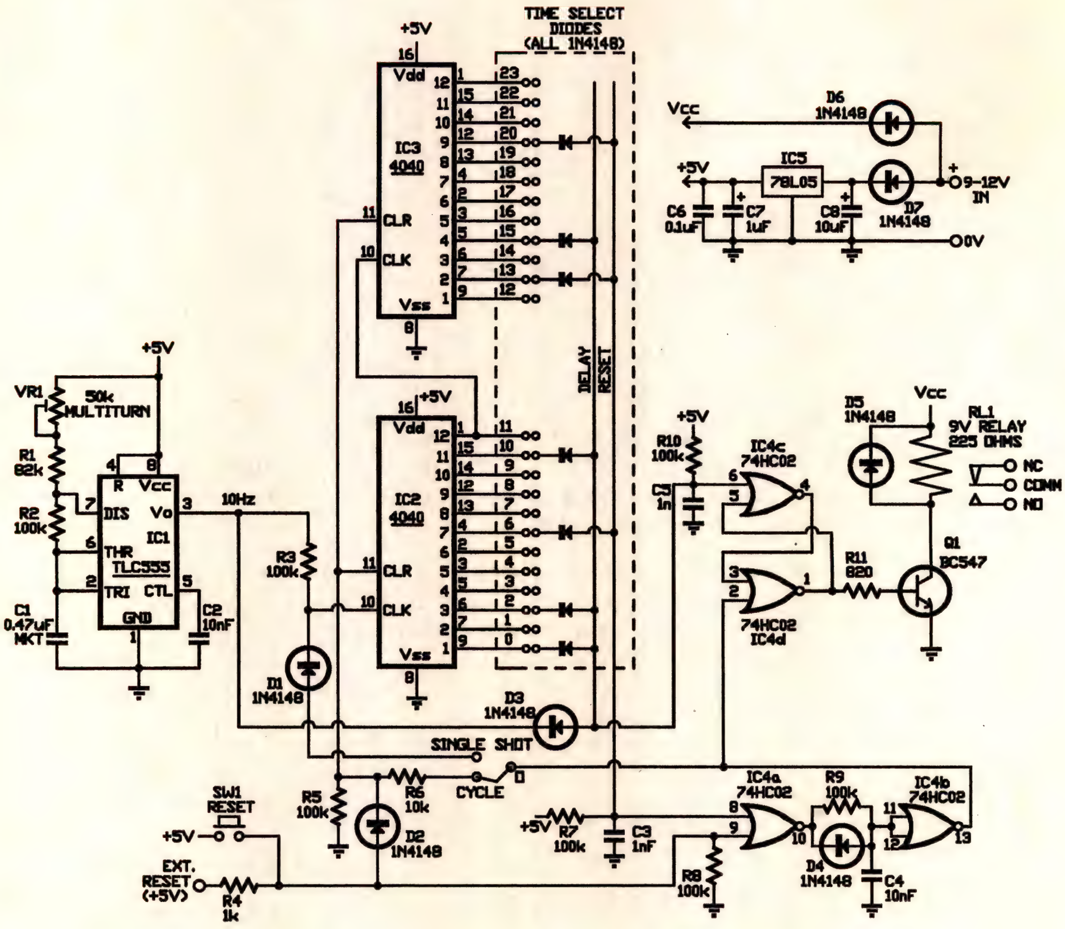
When the voltage across C1 reaches 2Vcc/3, the threshold (THR) input is triggered, causing both the output (Vo) and discharge (DIS) pins to go low (0V). In this state C1 begins discharging via R2. This process continually repeats itself, resulting in a sawtooth type waveform across C1 which swings between Vcc/3 and 2Vcc/3, and a rectangular waveform at the output which swings between 0V and Vcc. Both of these waveforms have a period of 100ms and a frequency of 10Hz when the circuit is calibrated.

The purpose of VR1 is not to vary the



And here's the PCB overlay diagram, which you can use in conjunction with the picture at top, to make absolutely sure everything is fitted correctly.

MULTI-TIMER MODULE



As you can see from the schematic, the timer uses only five ICs and a handful of discrete parts. Clock oscillator IC1 drives counter chips IC2 and IC3, to provide the main timing function.

program time, but to set the oscillator to exactly 10Hz, compensating for the +/-5% capacitance tolerance of timing capacitor C1 and the +/-1% resistance tolerance of the timing resistors.

The actual timing intervals are provided by two cascaded, 12-stage binary ripple counters IC2 and IC3. These counters consist of 12 cascaded flip-flops, each of which is internally triggered by the output of the previous one, giving a square wave output which is half the frequency of the output before it. The clock pulses are applied via R3 to pin 10 of IC2, triggering the counter only on the positive-to-negative transitions (also called the 'negative edge') of the clock pulses.

The counter outputs form a 24-bit binary number, with output 0 (pin 9 of IC2) being the least significant bit (LSB) and output 23 (pin 1 of IC3) the most significant bit (MSB). The numerical value of the counter output is equal to the time elapsed in tenths of a second since the counter was started.

Apart from the clock input, there are two other inputs to the counter. One is the clear (CLR) input of both IC2 and IC3 (pin 11), which resets the count to 0 when a logic 1 is applied to it, and the other is the anode of diode D1 which blocks the input clock pulses when the relay releases in one-shot mode, by 'forcing' the clock input of IC2 high (and over-ruling the clock pulses fed via R3).

The timer output comes from the isolated contacts of relay RL1. The relay is switched by transistor Q1, which is turned on when the output of NOR gate IC4d goes high. The two NOR gates IC4c and IC4d are interconnected to form what is called an RS flip-flop, the 'RS' standing for Reset-Set.

The RS flip-flop has three terminals: a reset input at pin 2, a set input at pin 6 and an output at pin 1. The way it works is that the two inputs are normally at logic 0 and if a logic 1 pulse is applied to the reset input, then the output is forced to logic 0 and stays in that state after the reset pulse is removed. If a logic 1 is applied to the set input, then the output is forced to logic 1 and stays in that state after the set pulse is removed.

The set input of the RS flip-flop is held low while any of the counter outputs connected to it via the time delay select diodes are low, and is also held low via D3 while the clock pulse line is at 0V.

When the count reaches the value

PARTS LIST

Resistors

(0.25W 1% metal film unless otherwise stated)

		Colour Code	
		4 Band 1%	**5 Band 1%**
R1	82k	Gry-Red-Org-Brn	Gry-Red-Blk-Red-Brn
R2,3,5,7-10	100k	Brn-Blk-Yel-Brn	Brn-Blk-Blk-Org-Brn
R4	1k	Brn-Blk-Red-Brn	Brn-Blk-Blk-Brn-Brn
R6	10k	Brn-Blk-Org-Brn	Brn-Blk-Blk-Red-Brn
R11	820	Gry-Red-Brn-Brn	Gry-Red-Blk-Blk-Brn

Potentiometers

VR1	50k multiturn trimpot

Capacitors

C1	0.47uF 100VW MKT (470n, 0.47u)
C2,4	10nF met. polyester (10n, 0.01u)
C3,5	1nF met. polyester (1n, 0.001u, 1000p)
C6	0.1uF 100VW ceramic (100n, 0.1u)
C7	1uF 50VW RB electrolytic
C8	10uF 16VW RB electrolytic

Semiconductors

IC1	TLC555 CMOS timer
IC2,3	4040 or 74HC4040 12 stage counter
IC4	74HC02 quad NOR gate
IC5	78L05 5V positive regulator
D1-Dn	1N4148 small signal diode (all)
Q1	BC547 NPN bipolar transistor

Miscellaneous

RL1	Relay, 9-12V coil
SW1	Pushbutton switch (normally open)
PCB	113 x 74mm, code ZA-1207

where all the outputs tied to delay time select diodes are high, resistor R10 pulls the set input high and the relay is operated. Although this condition can occur whether the other outputs are high or low, the important thing is that its *first* occurrence is when the other outputs are all low.

The reset pulse for the RS flip-flop comes via a pulse extender made with IC4a and IC4b. The function of this pulse extender is for its output (pin 13 of IC4) to change from logic 0 to logic 1 simultaneously with its inputs (pins 8 and 9 of IC4) going from 0 to 1, but for its output to stay at logic 1 for 1ms after its inputs go from 1 to 0. This delay is achieved by the time it takes C4 to charge via R9.

In cycle mode, a logic 1 from the pulse extender causes the counters and the RS flip-flop to be reset. In one-shot mode it causes the RS flip-flop to be reset, but the counter is prevented from counting, rather than being reset.

In a similar way to the set input, the reset input of the RS flip-flop is held low while any of the counter outputs connected via reset time select diodes to pin 8 of IC4 are low. When the count reaches the value where all the outputs tied to reset time select diodes are high, resistor R7 pulls pin 8 of IC4 high and the relay is released. Diode D3 ensures that the set input is low at the moment this occurs, because the clock is always at 0 for 50ms after it has triggered the counter.

In cycle mode the counter is now reset. The reset pulse is removed after the pulse extender delay, and the counting automatically starts again. In one-shot mode the counting stops and the reset input is held high until a manual or external reset pulse occurs.

The circuit does not automatically reset when power is applied, but this can be achieved if necessary by connecting a capacitor across the reset button.

The operating voltage range of the circuit is determined by, and is the same as, the voltage range of the relay, which is 8-12V. Voltages up to 15V can be used, but may overheat the relay if it is operated for long periods. Voltages below 8V are too low for proper operation of the +5V regulator IC5 which supplies everything except the relay.

Capacitors C6 to C8 are to ensure the stability of the regulator, while diodes D6 and D7 block the supply current in the event that the polarity of the supply is reversed, to prevent damage.

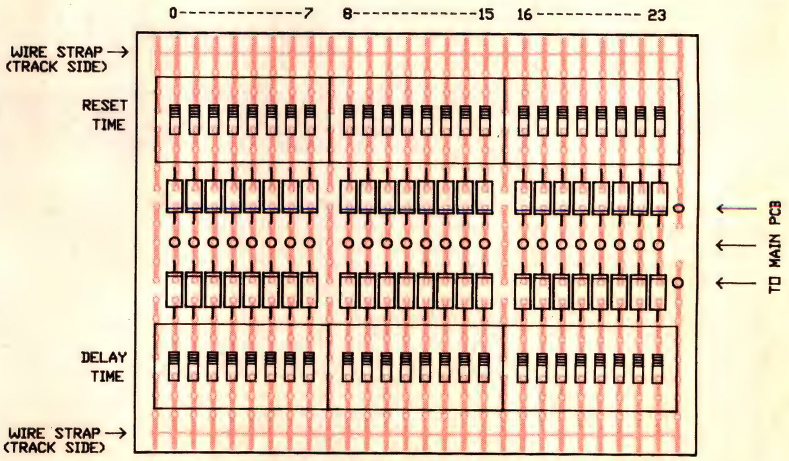
Clock calibration

The clock timing is adjusted by means of trimpot VR1. The easiest way to calibrate the clock is to connect a frequency counter to pin 3 of IC1 and adjust VR1 until the frequency is 10Hz, to an accuracy of about 0.0001Hz or better. Rotating the trimpot clockwise makes the clock go faster and so shortens the time.

Another way is to synchronise the clock signal with the 50Hz mains. Simultaneously view a sample of the mains voltage (the mains can usually be picked up simply by placing the CRO probe near a mains lead), and the 10Hz clock signal, and adjust VR1 until the two signals are synchronised — i.e., they have a fixed phase relationship and the waveforms do not drift past each other on the CRO screen.

If you don't have access to a frequency counter or CRO, then the calibration has to be done by adjusting the trimpot until the set time is correct. The trimpot can vary the clock frequency by about 16%, and it covers this range (depending on the type multiturn trimpot supplied) with about 16 rotations of the trimpot screw. By running the timer, and then calculating the time error, the approximate angle of rotation needed for adjusting the trimpot can be calculated.

For example, say that the timer is initially 1.5% too fast. By adjusting the trimpot by (1.5/16) x 16 turns = 1.5 turns anticlockwise, most of this error can be quickly removed. By operating the timer



Here is the overlay diagram for the optional auxiliary programming PCB which allows the reset and delay times to be programmed using DIP switches.

TABLE 1

Time value of programming diodes

Diode (bit)	Time (sec)	Diode (bit)	Time (sec)
23	838860.8	11	204.8
22	419430.4	10	102.4
21	209715.2	9	51.2
20	104857.6	8	25.6
19	52428.8	7	12.8
18	26214.4	6	6.4
17	13107.2	5	3.2
16	6553.6	4	1.6
15	3276.8	3	0.8
14	1638.4	2	0.4
13	819.2	1	0.2
12	409.6	0	0.1

in cycle mode, it can be left running for as long as necessary to get a large enough error measurement for calibration.

Programming

For any particular counter output bit (n), in the range 0 to 23, the elapsed time between the removal of the reset pulse and a logic 1 appearing at that output is given by the following formula:

$t(n) = 0.1 \times 2^n$ seconds ...(1)

When a number of outputs are connected together via programming diodes, the elapsed time between the removal of the reset pulse and a logic 1 appearing simultaneously at *all* of these outputs is simply the sum of the individual times:

$t = t(n1) + t(n2) + ...$ seconds ...(2)

And so the elapsed time between the removal of the reset pulse and the operation of the relay is determined by the sum of the times given by formula (1) for each DELAY TIME select diode that is installed on the PCB.

Table 2

Diode combination for 86,340 seconds

Diode	Time	Total Time	Remainder (86230-total)
19	52428.8	52428.8	33911.2
18	26214.4	78643.2	7696.8
16	6553.6	85196.8	1143.2
13	819.2	86016	324
11	204.8	86220.8	119.2
10	102.4	86323.2	16.8
7	12.8	86336	4
5	3.2	86339.2	0.8
3	0.8	86340	0

Similarly the elapsed time before the release of the relay is determined in the same way by which RESET TIME diodes are installed on the PCB. Again, this time is measured from the removal of the reset pulse — i.e., it *includes* the delay time.

Note that the operate and release times of the relay itself are *not* included in these figures, and are usually in the order of 30ms.

To explain the programming by example, say you want the relay to operate for one minute every 24 hours. This means that the time at which the relay operates (delay time) is at 23 hours 59 minutes after the reset pulse, and the time at which the relay releases (reset time) is at 24 hours after the reset pulse. Next convert the delay and reset times to seconds (using the conversions; 1min = 60sec, 1hr = 3600sec, 1day = 86400sec):

Delay time = 23 hours 59 minutes
= 23x3600 + 59x60 seconds
= 86340 seconds
Release time = 24 hours
= 24 x 3600 seconds
= 86400 seconds

Next select the combinations of delay time diodes and reset time diodes that give a total time of 86340sec and 86400sec respectively. Table 1 shows the time value of each diode as calculated from formula 1.

Table 2 shows the combination of diodes that give the exact time of 86340sec. The diodes are selected as follows. Firstly, starting with diode 23 and working your way down the list in table 1, find the diode that gives the highest time not greater than 86340. This is found to be diode 19 with a time of 52428.8sec. Next, subtract this time from the total (86340- 52428.8) to get the remainder 33911.2sec. Now look for the next diode down the list which has the greatest value not larger than 33911.2sec. This is found to be diode 18 with a time of 26214.4.

Add the time for all diodes selected so far, and subtract this from the total (86340-78643.2) to get the remainder, 7696.8. Keep adding diodes in this way until the remaining time is 0sec.

And so the delay time diodes that need to be connected for our example are 3, 5, 7, 10, 11, 13, 16, 18 and 19. Using exactly the same method, the reset time diodes are found to be 8, 9, 10, 11, 13, 16, 18 and 19.

Depending on the timing accuracy required, it will usually not be necessary to use more than about 10 or so diodes (the most significant 10) to set either the delay or reset times, omitting the smaller numbered ones. Make sure however that the difference between the reset and the delay time is correct. ❖

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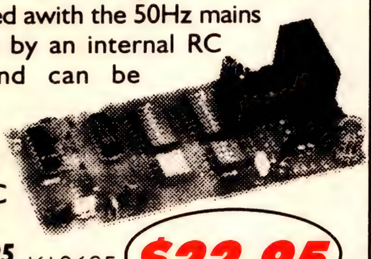

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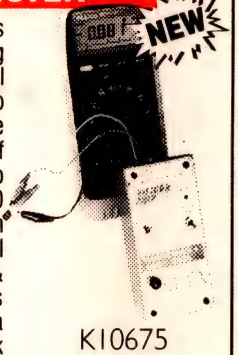

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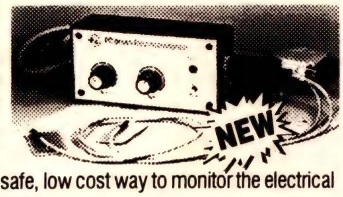

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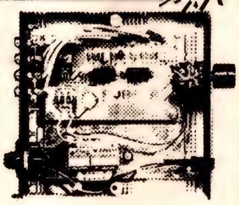

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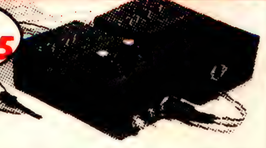

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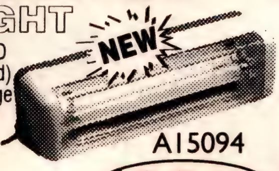

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720 X 720DPI SPECIAL COATED PAPER & GLOSSY PAPER.
360 X 360DPI ON PLAIN PAPER.

$799 TAX INC.

C92310 **$656** TAX EX.

This is a 64-nozzles (black), 3 x 20 nozzles (Magenta, Cyan, Yellow), colour inkjet printer •Multi-layer Actuator print head technology •Print speed: 400cps/LQ 20 cpi•Maximum resolution: 720 x 720 dpi•4 scalable fonts•5 bitmap LQ fonts•Friction feed with paper feeder•EPSON ESC/P2. IBM X24/X24E•Paper sizes: A4, Letter, B5, Legal, Statement, Executive, Envelopes (DL No.10) Index card (A6)•Accepts plain, special coated or glossy paper, and transparency film•Centronic® type 8-bit parallel interface/Macintosh® serial interface•Exclusive black & colour ink cartridge•433W x 248D x 198H mm

EPSON Stylus Black Ink Cartridge C92320..........$39.95
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720 X 360DPI ON SPECIAL COATED PAPER & GLOSSY PAPER.
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$659 TAX INC.

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This is a 64-nozzle colour/black inkjet printer. It uses a black or colour ink cartridge •Multi-layer Actuator print head technology •Print speed: 250 cps/LQ 20 cpi in black, 340cps in colour mode•Maximum resolution: 720 x 360 dpi•4 scalable fonts•3 bitmap LQ fonts•Friction feed with paper feeder•Up to 100 sheets at 64 gsm•Paper sizes: A4, Letter, Legal, Statement, Envelopes (DL No.10)•Accepts plain, special coated or glossy paper, and transparency film•Bi-directional parallel interface•Pack includes black & colour ink cartridges•397W x 206D x 144H mm

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Upgrade printhead and colour cartridge to make this printer become a Stylus Colour IIs!
Colour upgrade kit....$219 Cat No.92294

This is a 64-nozzle black inkjet printer (colour capable with optional colour upgrade kit)•Multi-layer Actuator print head technology •Print speed: 250 cps/LQ 20 cpi•Maximum resolution: 720 x 360 dpi•4 scalable fonts•3 bitmap LQ fonts•EPSON ESC/P2•Friction feed with paper feeder•Up to 100 sheets at 64 gsm•Paper sizes: A4, Letter, Legal, Statement, Envelopes (DL No.10)•Accepts plain, special coated or glossy paper, and transparency film•Bi-directional parallel interface•Exclusive ink cartridge•Dimensions: 397W x 206D x 144H mm

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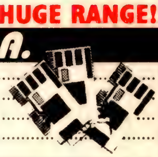

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Specifications subject to changes. *X18161 without Boot Roms.

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X18099	VESA 1 Meg TRIDENT 9400	$129
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X18087	VESA WD Accelerator Video Card	$209
X18167	VESA VGA S3 Accelerator	$169
X18185	VESA ET-4000 TSENG LABS	$199
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P.C.I.

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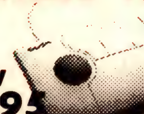
X18183	PCI VGA CIRRUS LOGIC 5430	$175

QUICKSHOT QUICKTRAC 100



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100% Microsoft Mouse compatible, the QuickTrac 100 works with any application that works with the MS Serial Mouse. It includes QMenu™ program to add mouse support to any program not designed to be used with a mouse. It gives precise control over your applications with a large thumb-controlled tracking ball and 3 large, easy-to-use contol buttons

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In-built loud speakers are the unique feature of this computer case. Just perfect for those who need all their desktop space! Features include: •Slide in top -perfect for schools•200 watt power supply•Size: 360W x 400D x 135H mm• 3 digit display•Two in-built speakers•8 Slots and mounting accessories•Security key switch

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75/90/100 MOTHERBOARD NEW

This board corporates system board and PCI IDE in one board that provides all the PC solution. The mainboard is a Pentium TM micro processor based PC/AT system, supports 256KB to 1MB cache with ISA Bus and PCi Local Bus to upgrade your system performance. Ideal for multi-tasking and fully supports MS DOS, Windows/NT, Novell, OS/2, etc.

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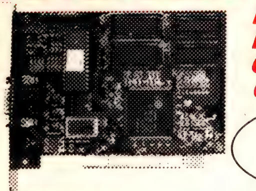

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Features
• Fully IBM VGA compatible • Support VESA standard software by BIOS built-in functions • Support PCI-33MHz (2.0) system with Burst mode • 64-bit GUI acceleration (32-bit for 5430) • 64 x 64 hardware cursor • Support 72Hz vertical scan refresh rate • VESA standard feature connector • Built-in clock chip and a true colour (24bit, 16 million colours) RAMDAC • 64-bit memory data bus support up to 4MB DRAM (2MB for 5430 and5434PCI/SMT model) • Green PC support including DPMS-compatible BIOS, jumper for light-greenmotherboard and power-saving utilities • Support VGA, SuperVGA, and Enhanced VGA resolution in 16, 256, 64Kand 16.7 Million simultaneously colours

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Speed: 14400/12000/9600/7200/4800/2400bps

Compatibility: CCITT V.17/29/27ter and V.21 ch2. Support Group 3 send/recieve fax EIA/TIA Class 1 and 2 command set

Command Buffer: 40 characters

Data Format: Serial, binary asynchronous, 7 or 8 data bit, odd, even or no parity, one or two stop bit, totally 10-bit length, binary synchronous.

Package contains:
- Modem unit
- Telephone Cable
- Operation Manual
- Power Adaptor
- Data Communication Software
- Fax Application Software

X18596 **$469**

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Compatibility: CCITT V.32bis/32/22bis/22 Industry standard AT commands compatible MNP and V.42/42bis Error Correction/Data compression

FAX MODE:
Speed: 14400/12000/9600/7200/4800/2400bps

Compatibility: CCITT V.17/29/27ter and V.21 ch2. Support Group 3 send/recieve fax EIA/TIA Class 2 command set

Command Buffer: 40 characters

Data Format: Serial, binary asynchronous, 7 or 8 data bit, odd, even or no parity, one or two stop bit, totally 10-bit length, binary synchronous.

X18590 **$199**

Package contains:
- Modem unit • Telephone Cable
- Operation Manual • Power Adaptor
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HONEYWELL MOUSE

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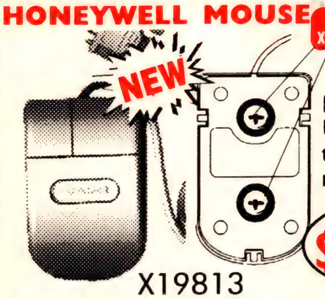

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Using a unique "no ball" tracking technology, this mouse redefine the design concept for mice. It can be used on almost any surface horizontally or vertically. Its low maintenance design makes it ideal for school or workshop environments.

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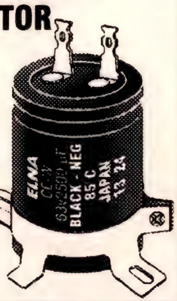

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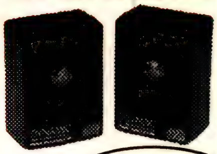

C10700 **$15.95**

SPEAKER TYPE:
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INCORPORATING THE QUAD-SPEED CD-ROM DRIVE, 4 MB RAM AND THE CPU PROCESSING POWER OF YOUR CHOICE.

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Pentium™ 100	$2359	**$2699**
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CPU CHOICES	TAX EX	TAX INC
DX2-66	$1919	**$2219**
DX2-80	$1969	**$2249**
DX4-100	$1989	**$2289**
Pentium™ 75	$2489	**$2789**
Pentium™ 90	$2599	**$2899**
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486DX2-80	$1125	$1372
486DX4-100	$1199	$1462
Pentium™ 75*	$1595	$1945
Pentium™ 90*	$1720	$2098
Pentium™ 100*	$1810	$2200
Pentium™ 120	$2190	$2672
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*External 256K Cache

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Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide further information.

Tap-on connections

Recently I have been installing a lot of circuits into vehicles that require connection to the existing wiring loom for power etc. I generally use automotive tap-on connectors, but these have several drawbacks. For example, the size of the connector must match the gauge of wire being tapped into, and sometimes the connectors come apart after being squashed together (especially cheap ones). As well, the gauge of the additional wire has to be about the same as the one being tapped into, which makes it hard to connect thin hook-up wire into thick power cables.

An alternative tap-on connector can be made with a pin, a homemade perspex tool and a screw terminal. The tool is simply a block of perspex, drilled with a number of holes to accept a conventional pin. File a notch over the opening of the deepest hole to accept a rubber band. To use the tool, place the pin head first into the deepest hole of the tool. Use a rubber band to hold it there in awkward places.

Then poke the pin into the insulation of the cable being tapped into, and press it into the conductor. Use successively shallower holes in the tool as the pin goes further into the cable. This will stop the pin bending.

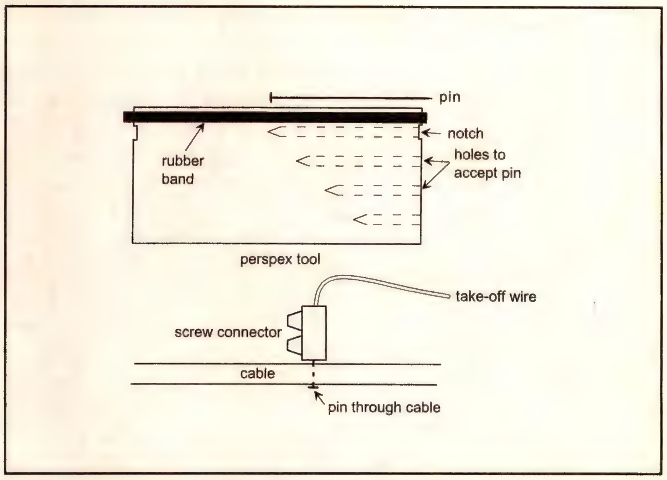
When the pin is all the way through the cable, fit a screw connector over the pin, then connect the required tap-off wire (of any thickness) to the screw connector. Finally put a bit of tape over the exposed pin head to insulate it.

Nickel-plated brass pins work well, as they are soft and can be bent so the screw connector lies flush on the cable so the extra wire can run parallel to the existing one.

Plastic headed pins with a soft shaft would be ideal, as the head is already insulated. So far I have found this method to be quick, reliable and able to handle fairly large currents. The pins will also go through thin stranded wire and don't damage the cable if the connection is later removed.

Do not use this method on mains wiring.

Grant Bourne,
Auckland, NZ. **$30**



Engraving pen

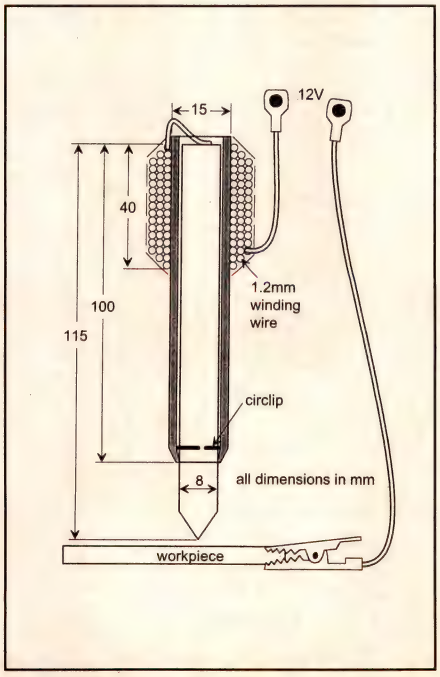
I made this pen about 40 years ago, based on the 'Vibrascope' engraving pen, from the original makers of the Scope soldering iron. The pen still works well today.

The tip is from an original unit and is a 115mm long, 8mm diameter steel rod said to have a tungsten insert of about one or two millimetres diameter, ground to a conical point.

Whether the tip is tungsten or tungsten carbide is not clear, as the terms are regularly misused. Tungsten can be obtained from the electrode of a TIG welder, and tungsten carbide from a drill.

The coil is 40mm long and has three layers of 1.2mm enamelled copper wire wound on a 15mm OD, 100mm long brass body. Incidentally, the unit doesn't work if the coil is wound over the full length of the body.

Cover the coil with fibreglass electrical tape to hold the windings together. Otherwise make a former with cheeks to hold the coil. The coil gets warm with prolonged use.



Connect the electrode body to the start of the coil with flexible braid. The other end of the coil connects to the 12V supply, again with flexible braid. The workpiece connects to the other supply terminal.

The circuit is therefore from the supply to the workpiece, through the electrode to the coil, through the coil back to the supply.

When the tip contacts the work, current in the coil lifts the electrode, causing an arc that etches the workpiece most effectively. When the circuit breaks, the coil is de-energised and the electrode falls back to the workpiece (only a few hundredths of a millimetre), and the cycle starts again.

I use a 12V transformer capable of a few amperes, but the pen should work from a 12V car battery. For best results, hold the pen vertically. It will work well on hard or soft stainless steel, brass or aluminium.

Peter Grout,
Forestville, NSW. **$35**

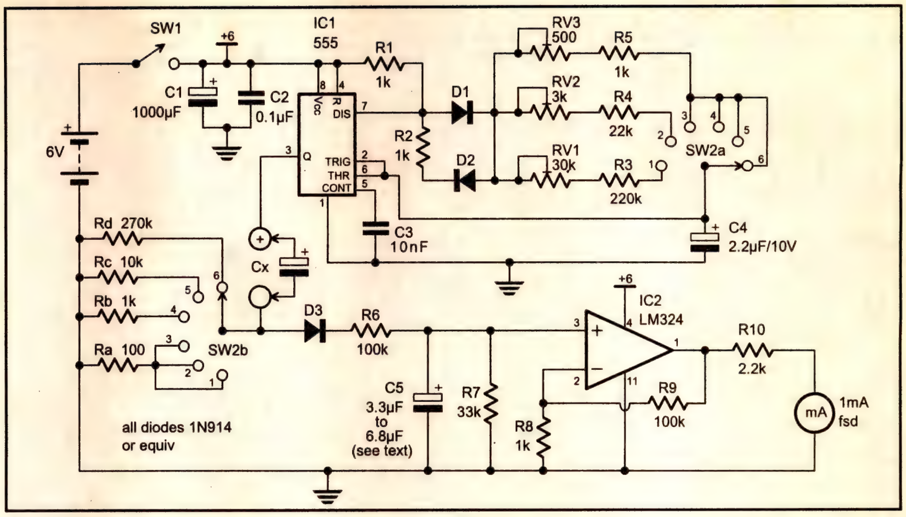
Capacitance meter

This simple and easy to build capacitance meter has six ranges: 1nF, 10nF, 0.1uF, 1uF, 10uF and 100uF. It works as a result of an AC current that flows through the capacitor when it's connected to the test terminals. The current develops a voltage which is then amplified by op-amp IC2. The output of the op-amp drives a 1mA meter movement to give a readout of the capacitance value.

The AC source is developed by IC1, a 555 timer connected as a free running oscillator. Its frequency is changed by SW2a from 1Hz (position 1), 10Hz (position 2) to 100Hz (positions 3 to 6). The current through the unknown capacitor flows through the resistor selected by SW2b (Ra to Rd) and the voltage developed across the selected resistor provides the signal voltage for the op-amp.

To set up the meter, select position 3 for SW2 (100Hz frequency). Connect a known capacitance of 1uF across the test terminals and adjust RV3 to give full scale deflection. Confirm that the meter shows half scale for a 0.5uF capacitance value, and one tenth deflection for a 0.1uF capacitor.

Select position 2 of SW2 and repeat the above by adjusting RV2, but this time with a 10uF capacitor, a 5uF and a 1uF capacitor. Do the same for position 1 of SW2, by adjusting RV1, using a 100uF, a 50uF and a 10uF capacitor.



When SW2 is set to position 1, the test frequency is 1Hz, which can cause the meter pointer to pulse.

To reduce this effect, try increasing the value of C5. I found the maximum value for C5 was 6.8uF, and that higher values caused the meter to read inaccurately. However, I suggest you first adjust the meter using a 3.3uF capacitor for C5, then increase its value if necessary.

Once the meter is adjusted, it should read accurately for the remaining scales providing the resistance values of Rb, Rc and Rd are correct. The value of Rd is not 10 times the value of Rc due to the parallel resistance of R6 (in series with R7). It may be necessary to adjust the value of Rd for best accuracy.

David Francis,
Cannonvale, Qld. **$45**

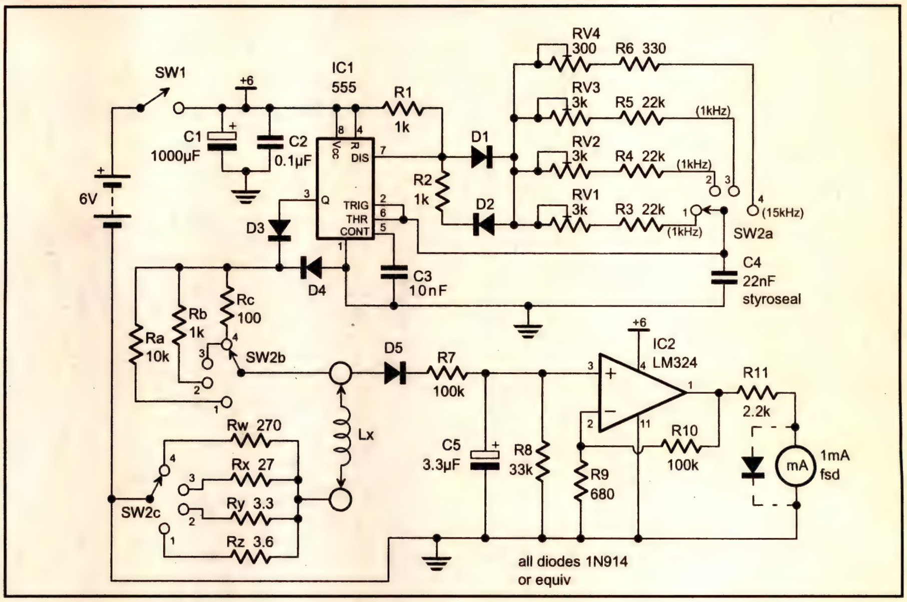
Simple inductance meter

This simple inductance meter has four ranges: 30uH to 100uH, 100uH to 1mH, 1mH to 10mH and 10mH to 100mH. It works by measuring an AC voltage developed across the test inductor. This voltage is amplified by op-amp IC2, which drives a 1mA meter movement to give a readout of the inductance value. The higher the inductance, the higher the voltage developed across it.

The AC voltage source is produced by IC1, a 555 timer connected as a free running oscillator. Its frequency is changed by SW2a from 1kHz (positions 1 to 3) to 15kHz (position 4). SW2b selects a scaling resistor and SW2c selects a resistor to linearise the lower scale readings. The test current therefore flows through the resistor selected by SW2b (Ra to Rc), the unknown inductor and the resistor selected by SW2c (Rw to Rz). The voltage developed across the inductor and the resistor selected by SW2c provides the signal voltage for the op-amp.

To adjust the meter, set SW2 to position 1 (1kHz frequency). Connect a known inductance of 100mH across the test terminals and adjust RV1 to give full scale deflection. Confirm that the meter shows half scale for a 50mH inductance value.

Set SW2 to position 2, and adjust RV2 for full scale deflection for a 10mH inductor, and check for half scale deflection for a 5mH inductor. Repeat this procedure for position 3, adjusting RV3 for full scale deflection for a 1mH inductor. For position 4, use a 100uH inductor and adjust RV4. If you can't get a full scale reading, reduce the value of R9. If the meter reads too high, increase the value of R9.



If you are having problems adjusting the meter, confirm that the output of IC1 is a 1kHz 50% duty cycle square wave on positions 1, 2 and 3. On position 4, the frequency is 15kHz.

A characteristic of the instrument is that the meter will read beyond full scale when the test terminals are not connected to an inductor. To protect the meter movement, connect a diode across its terminals, but only after the instrument has been calibrated.

David Francis,
Cannonvale, Qld. **$45**

Construction project:

INDUCTION LOOP TV HEADPHONES

Here's a novel way to listen to the television (or CD player) with headphones, without long trailing wires back to the set — handy for listening to TV in bed, or for getting 'that little bit more volume' without irritating other members of your family...

by GRAHAM CATTLEY

Induction loops — when most people think of them, they think of hearing aids. Which is not surprising, as the induction loop principle has been used in these devices for many years as a simple, low cost way to receive audio information, without the need for complex RF circuitry.

Of course, you don't need a hearing aid to make use of the principle, and thus we have developed the Induction Loop Pickup which gives you an amplified audio output into a normal pair of headphones. There are many uses for such a system, including, as mentioned above, cordless headphones for television listening.

Another idea is an in-house 'radio' station. As there is theoretically no limit to the number of pick-up units that can be used within the loop, a simple CD or tape player (or even a microphone) connected to the loop could provide a private radio station — useful for playrooms and bedrooms. A remote control system is another possibility, but we leave the details to the reader's ingenuity.

Circuit description

The induction loop system consists of two parts, the small pick-up unit, and the induction loop itself. This loop is made from several turns of wire secured around the edge of the room and is driven by the audio output of the television set or amplifier.

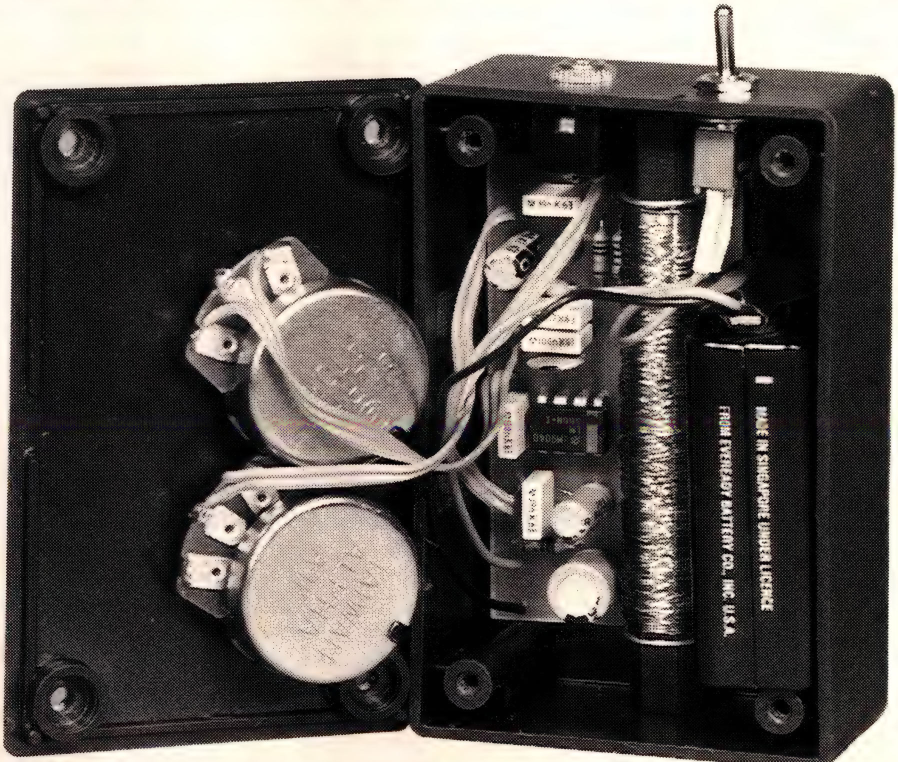
As the DC resistance of the loop is approximately the same as the impedance of a standard speaker (eight ohms), the television drives the loop as though it were a speaker, and thus a fluctuating magnetic field with the same characteristics as the original audio signal is produced within the room.

Whenever the pick-up unit is inside the loop, the loop becomes the primary and the pick-up coil (L1) the secondary of a (very) loosely coupled transformer. With four turns in a loop the size of a normal room, and 800 turns on the pick-up coil, you'll get an AC signal of around 1-2mV across L1. This AC signal is passed to the base of Q1 by C1 which, with the input impedance of Q1, helps to filter out the ever-present 50Hz mains hum. (You can imagine that hundreds of metres of house wiring looped within the walls will produce a great deal of unwanted 50Hz noise.)

Q1 is set up in a self-biasing configuration with R1 providing a small amount of negative feedback. This gives a reasonable amount of gain, and also allows us to provide a tone control (VR1).

This control in series with C5, shunts the emitter resistor R3 so that the amplifier provides a variable amount of extra gain at higher frequencies. C3 provides roll-off at the high end of the audio spectrum, which prevents the circuit from falling into high frequency oscillation, while C2 capacitively couples the output of the transistor to the volume control and also provides more filtering to cut down on the mains hum.

IC2 is an LM386 audio amplifier capable of delivering just over half a


MADE IN SINGAPORE UNDER LICENCE
FROM EVEREADY BATTERY CO. INC. U.S.A.

This photo shows how to fit everything into the case. Keep all wiring as short as possible, otherwise you will have difficulty fitting everything in.

watt into an eight-ohm load. It has a gain internally set to 20, and this is more than enough to drive a pair of headphones through C7. Components R4 and C6 are used to ensure that IC2 operates in a stable fashion.

Because most earphones these days have an impedance of 32 ohms, and as we are only dealing with a mono signal, we can short the tip and ring of the earphone socket together to give a 16-ohm load to the amplifier. This will result in a slightly higher volume, and (more importantly) both left and right phones being driven. (You tend to find yourself walking around in small circles if you only have one earphone running!)

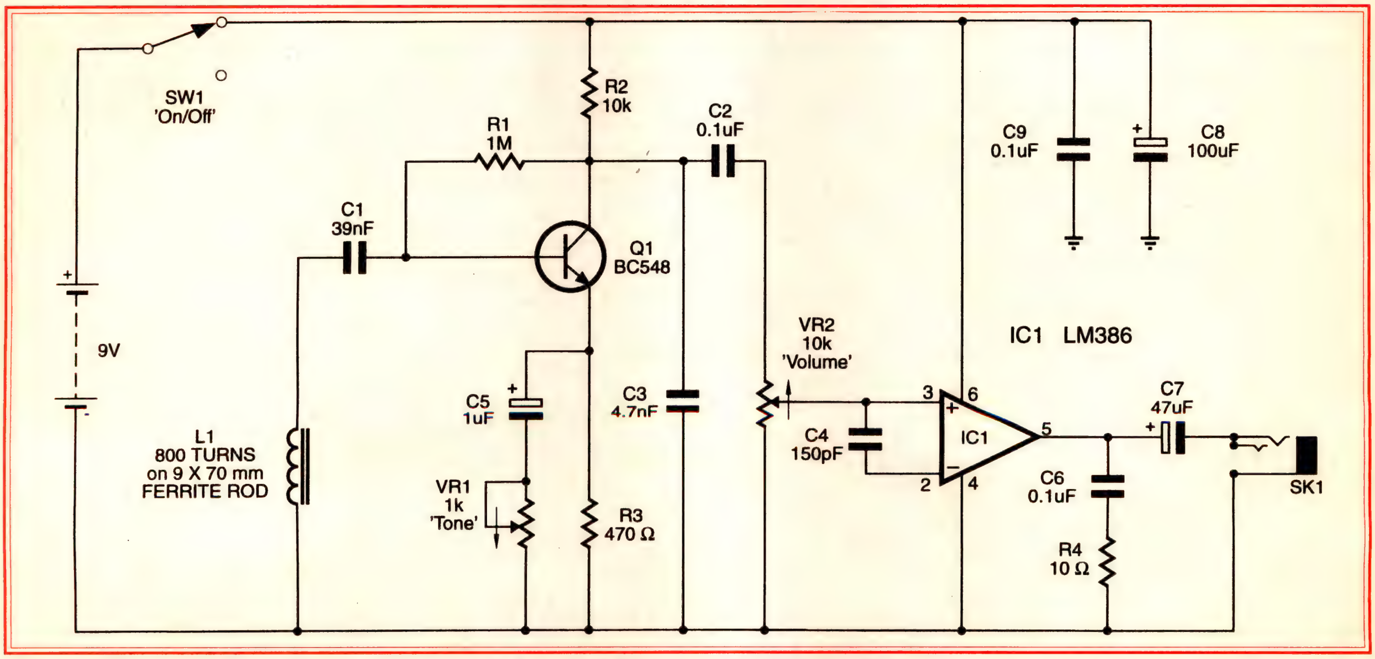
Looping the loop

The induction loop consists of several turns of wire, laid out around the perimeter of the room, with the two ends of the loop connected to the speaker output of the television.

Four-core telephone style cable is strongly recommended — both for its tough outer sheath, and the fact that it is easy to interconnect the four inner wires to give a four-turn loop, while at the same time only laying down a single cable. Note that this is the older style cable — steer clear of the newer flat telephone cable used with the modular phone plugs, as this is almost impossible to solder...

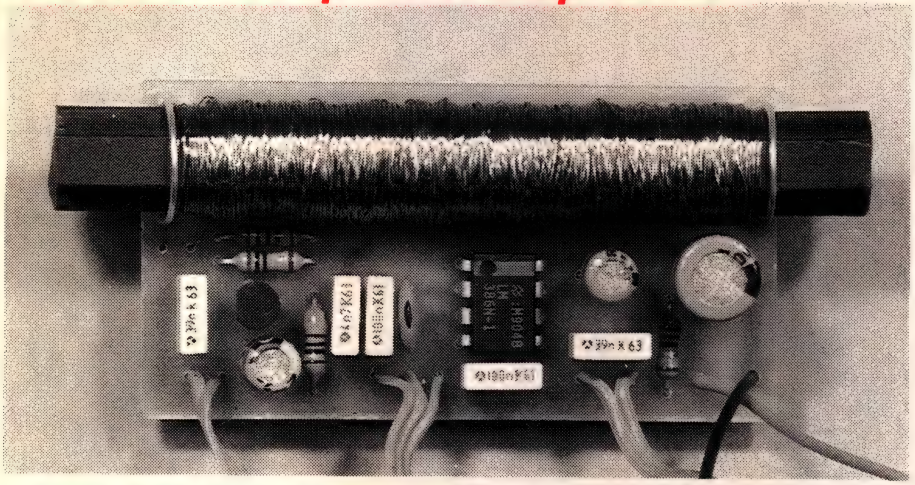
Of course, the more turns there are in the loop, the stronger the signal received by the pickup, but you'll find that four turns should be enough for an average sized room.

In case you were wondering, the way to interconnect the telephone cable is as follows: Take the (say) red line on one end of the cable, and join it to the blue line on the other end. then join blue to



The complete circuit diagram for the Induction Loop pick-up. Q1 boosts the signal received by L1, while providing a tone control (VR1). IC1 is a small audio amplifier, used to drive a pair of stereo headphones.

Induction Loop TV Headphones



A close up of the board. The two links used to secure the coil can be clearly seen in this photo. Note that we used a 39nF for C6 in the prototype.

white, and white to black. You will now have an unused red and an unused black line; these are now the ends of the four-turn loop you have just created.

The loop would be best placed under the skirting boards or carpet around the edge of the room, but there is no reason why you couldn't mount it under the floorboards, or even along the rafters in the attic above the room, if that's easier.

When you're finished, get your multimeter out and measure the resistance of the finished loop. It should have a DC resistance of at least eight ohms — if it is less than this, insert a resistor of a suitable value in series with the loop to bring the total loop resistance up to eight ohms. This is to prevent the television's amplifier from being overloaded when driving the loop.

Run a length of twin-core cable terminated in a two-pin DIN plug from the loop, and make sure that all of the connections in the loop are well insulated, and tucked out of harm's way.

Pickup construction

The Induction Loop Pickup is constructed on a small PCB measuring 60 x 32mm, and coded 95il10. Start by installing the transistor and four resistors, followed by the capacitors and the IC. The only other component to be mounted on the PC board is the coil, which is held in place by a pair of wire links.

To wind the coil, you will need a 75mm length of 9mm diameter ferrite rod, and around 35 metres of fine winding wire. The wire gauge is not terribly critical, and anything around 30 - 36 B&S (roughly 0.2mm) will do.

Using a sharp triangular file or hacksaw, cut a notch around the ferrite rod, 75mm from one end. Hold the rod in both hands and gently snap it in two. With any luck, the rod will break cleanly along the notch.

The easiest (by far) method of winding the coil is with either a low speed battery powered drill or a (gasp!) hand drill. Grasp 10mm of the rod in the drill chuck, and start winding the wire on slowly, counting the turns as you go. (800 turns were used in the prototype, but if you're feeling ambitious, an extra couple of hundred turns can only help — the only limit is whether the finished coil will fit inside the case.)

If you're going to wind the coil by hand, sit down quietly somewhere and have some sticky tape near by, in case you need to stop halfway through.

Once finished, mount the coil on the PC board using two U-shaped 'staples' of tinned copper wire to hold it into place, and solder the coil's leads to the two pads on the board. Run short lengths of hookup wire out to the two pots, and the battery clip with switch, as shown in the photos. The phono socket is a stereo type, and the tip and ring contacts should be wired together — this produces a mono signal in both ears with a normal pair of stereo headphones.

Drill the holes in the box for the switch and earphone socket, and two holes in the lid for the pots. These 'potholes' must be in the positions shown on the photos, as there is little

PARTS LIST

Resistors

All 1/4 watt 5%

R1	1M
R2	10k
R3	470 ohms
R4	10 ohms
VR1	1k log potentiometer
VR2	10k log potentiometer

Capacitors

C1	39nF MKT
C2,C6,C9	0.1uF MKT
C3	4.7nF MKT
C4	150pF disc ceramic
C5	1uF 16VW electrolytic
C7	47uF 16VW electrolytic
C8	100uF 16VW electrolytic

Semiconductors

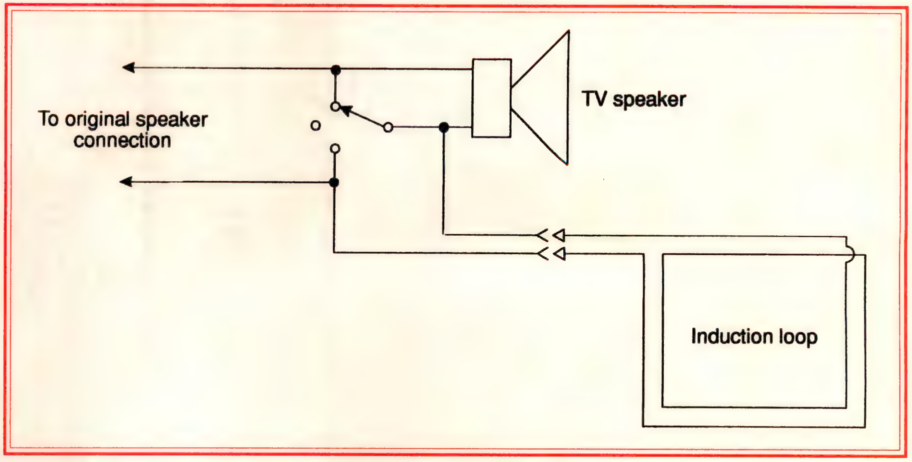
Q1	BC548 NPN transistor
IC1	LM386 Low power audio amp

Miscellaneous

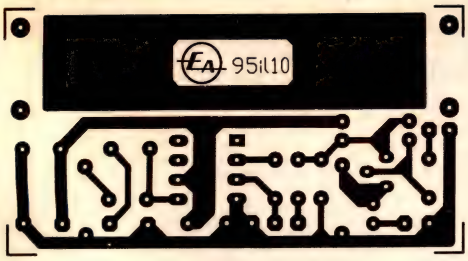
PCB, 60 x 36mm, coded 95il10; Plastic box to suit, size 82 x 53 x 30mm; 2 x 20mm plastic knobs; 9V battery clip; 75mm long, 9mm diameter ferrite rod; approx. 35 metres of 30 - 36B&S (0.2mm) winding wire; SPDT toggle switch; 3.5mm panel mount stereo socket; hookup wire, solder, etc.

For the loop:

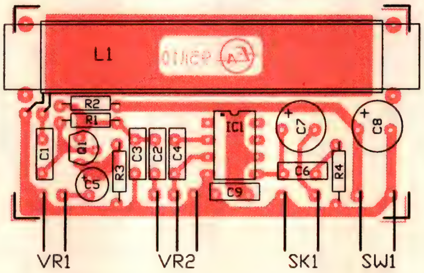
Four-core telephone style cable; two-pin DIN plug and panel mount socket; SPDT centre off toggle switch; Insulation tape, etc.



The diagram above shows how to connect the induction loop to a television set. The three position switch will allow you to select from speaker only, loop only, or loop and speaker together.



Here's the PCB artwork, reproduced here full size, in case you want to make your own board.



And here's the PCB overlay diagram. Watch the orientation of the electrolytics and Q1. Construction of the board is a lot easier if you install L1 after all the other components.

clearance inside the box. If you use a photocopy of the front panel artwork as a guide when marking out the holes, everything should fit in nicely.

Trim the pot shafts to suit the knobs, and mount them along with the switch and phono socket in the box. Install a 9V battery, and all you need to do now is find a pair of earphones.

Driving the loop

The loop can either be connected to the speaker terminals of an amplifier (for use with CD players etc.), or to the speaker terminals inside your television set.

Before attempting to connect the loop to a television set, a word of warning: Most modern sets are 'Hot Chassis', which means that they're almost certainly going to have the chassis at mains potential.

DO NOT connect anything to any part of these sets, unless you are fully competent, and know exactly what you're doing. If you have the slightest doubt about any aspect of the following procedure, or are not sure as to the type of television set you own, ask a qualified technician to do the job for you.

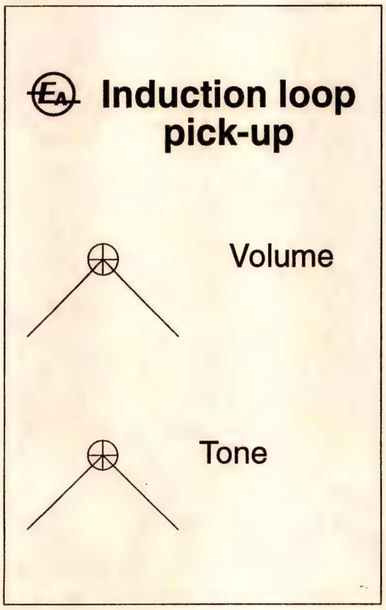
There are a couple of ways to connect the loop to the speaker within the set, either in series with the existing speaker, or switched, so that the loop or speaker can be switched in or out of the circuit. Fig.1 shows such an arrangement, with an SPDT toggle switch used to select either speaker or loop output; if this arrangement is used with a centre-off switch, the centre position will give both speaker *and* loop output.

Assuming that you are going with the switch, mount it, along with the two-pin DIN socket, in an insulated part of the television's cabinet (preferably out of sight, around the back).

Disconnect the leads from the television's existing speaker, and wire the switch, DIN socket, and speaker up as shown. Double check everything, and make sure that at no time can anyone come into electrical contact with any of the wiring. When you are happy with everything, re-assemble the television and plug in the loop.

Set the television's volume to a normal level. Plug a pair of headphones into the pickup unit and switch it on, and you should hear the slight background hiss of the amplifier. Switch on the television and with a bit of luck, you'll get the program's sound in the headphones.

You can now wander around, free from trailing leads, and still hear the television from even the furthest corners of the room. You'll find that the pick-up is directional, in that it performs best when it is held perpendicular to the loop, but this shouldn't be much of a problem in normal use. ❖



This is the front panel artwork. As the placement of the two pots is fairly critical, use a copy of this artwork to mark out the box lid before drilling.

ROCOM

ELECTRONIC COMPONENTS

SALE!! SALE!!

CRYSTALS

4.0MHz	H123	$0.80
8.0MHz	H123	$0.80

DIODES

1N4148	DO35 75mA 75V	$0.015
BA317	30V 225mA Gen. Purp.	$0.05

LEDS

3mm	GREEN LED	$0.06
3mm	RED LED	$0.06

INTERGRATED CIRCUITS

CA3118AT	High Volt. Trans. Array	$0.50
LM386N	Low Volt. Audio Pwr Amp.	$0.25
LM556N	Dual Timer	$0.30
LM1458N	Dual Operational Amp.	$0.40
LM3403N	Quad Op Amp DIP	$0.40
NE555	Timer CMOS	$0.20
TC574096-120	16 x 256K EPROM	$5.00
ULN2003	Darl. Trans. Array	$0.25
4066	Quad Analog Switch	$0.25
74HCT02	Quad 2-Input NOR Gate	$0.20
74HCT125	Quad 3-State Buffer	$0.20
74HCT126	Hex D Flip-Flop	$0.20
74HCT153	Dual 4-Input D/Select.	$0.20
74HCT373	Octal D-Type Trans. Lat.	$0.20
74LS123	Dual Retrig. Mono Mult.	$0.20
74LS367	Hex Buffer. 3-Slate	$0.20

REGULATORS

LM317T	TO-220 +ADJ 1.5A	$0.50
LM2575T-50	5V Switchmode reg.	$1.00
MC7805T	TO-220 +5V 1.5A	$0.30
MC7812T	TO-220 +12V 1.5A	$0.30
MC7815T	TO-200 +15V 1.5A	$0.30

TRANISITORS

BC547B	NPN 45V 0.1A 500mW TO-92	$0.06
BD140	PNP 80V 1.0A 8W TO-126	$0.25
BD291	NPN 45V 6A 60W TO-126	$0.20
BD292	PNP 45V 6A 60W TO-126	$0.20
TIP30C	PNP 100V 5A 30W	$0.50
TIP36C	PNP 100V 25A 125W	$2.00

LCD DISPLAY

LIQUID CRYSTAL DISPLAY MODULE
2 X 16 LINES (WITH DRIVER) $12.00

STOCK IS SUBJECT TO PRIOR SALE.

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READER INFO NO. 17

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OCTOBER DEALS FROM JAYCAR

NOISEBUSTER

Personal Active Noise Reduction Headphones

As seen on Beyond 2000

1994 winner "The Discover Awards" for technological innovation

NEW

THESE HEADPHONES ARE AMAZING!!! They not only produce good quality audio sound like normal headphones, they REDUCE outside noise.

HOW DO THEY WORK? The stereo headset features two microphones that continuously sample background noise. The data is fed into a high speed processing chip, which signals the headsets speakers to generate noise thats the exact mirror image of the offending waveform. The two waveforms cancel each other out. They are designed to cancel the most irritating monotonous drones, from lawn mowers and leaf blowers to aeroplanes and truck engines to air conditioners and computer fans etc.

And because the NOISEBUSTER is tuned to erase only sounds in the 30-1200Hz range, you can still clearly hear voices and sounds around you. For example - in aircraft, they will eliminate up to 95% of cabin noise, and you can listen to the movie or radio programs. Use with or without music.

HOW EFFECTIVE IS NOISEBUSTER AGAINST SPECIFIC NOISE?

•Aircraft cabin noise: up to 95% reduction •Automobile: up to 80% reduction •Train/subway: up to 70% reduction •Lawn mower: up to 60% reduction

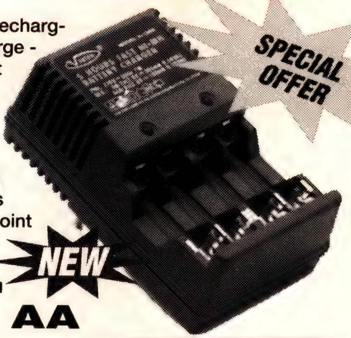
The best way to convince yourself how good these really are - is to call in to any Jaycar store and try them! You will be as amazed as we were!

Cat. AA-2000 **ONLY $149**

JayTech Fast Ni-MH Battery Charger

Features:

•Charges 2 or 4 pcs AA or AAA rechargeable Ni-MH batteries •Fast charge - 5 hours •LED lamp indicates fast charge and trickle charge •Built in safety temperature sensors to avoid the battery from damage by overheating •Built in IC timer control •Auto selects the correct charge rate for AA or AAA •Plugs directly into 240V mains power point •Electricity authority approved.

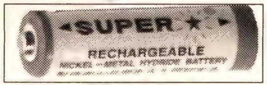


SPECIAL OFFER

NEW

Cat MB-3509 $39.95

1.1A NI-MH AA BATTERIES



$5.95ea Cat. SB-2455

Buy the MB-3509 charger and 8 x SB2455 batteries for only $79.95. SAVE $7.60

Alkaline Battery Charger

NEW

BRAND NEW MODEL

Prolong the use of your alkaline and zinc carbon batteries with the new "Battery Master" intelligent charger. It will charge zinc carbon, alkaline and nicad batteries in sizes AAA, AA, C and D. It will charge four at a time. The Battery master has a built in microprocessor which monitors the charging of each battery. A tri colour LED for each battery shows you the state of charge. LEDs are green when plugged in. A red LED indicates either a battery has been incorrectly inserted or is too old. Amber LED indicates charging is in progress and a green LED shows batteries are charged. SAVE MONEY AND HELP THE ENVIRONMENT!!! AC adaptor is extra. Requires 9VDC 500mA. Use an existing one or purchase cat MP-3008 9VDC 800mA $22.95.

Cat. MB-3525 **$49.95**

DOLBY PRO LOGIC KIT FOR UNDER $200!!

DOLBY SURROUND PRO · LOGIC

Yes, you can now buy the Dolby Pro Logic short form kit (KC-5175) and the enclosure kit (KC-5176) for $199.

SAVE $40 $199

DOLBY PRO LOGIC CENTRE SPEAKER KIT BARGAIN

Kit includes:

•2 x 5" shielded woofers Cat CW-2102	Value $79.90
•1 x 1" shielded dome tweeter Cat CW-2006	$16.95
•1 x crossover network Cat CX-2613	$8.50
•1 x set box plans / wiring details	$105.35

Only $89 SAVE OVER $16 Cat. CS-2500

8" SUBWOOFER SALE

Quality Max Sound woofer. Similar to models used in EA's subwoofer article in June 92. The specs have changed slightly. Recommened vented box size 44 litre. Sealed box size 35 litre. See 1995 cat P43 for full details and specs.

- Impedance 8Ω
- Power 80WRMS

CAT PRICE $99.50
SAVE AN AMAZING $40
Cat. CW-2150
Oct Price
$59.50

SAVE ON 24V TO 12V REDUCERS

3 AMP UNIT
Cat Price $49.95
Oct $42.95
Save $7 Cat. MP3058

7 AMP UNIT
Cat Price $92.50
Oct $79.50
Save $13 Cat MP3060

FREECALL FOR PHONE ORDERS 008 022 888

RCA Plug To TV Coax Lead

•1.25 metres **CAT PRICE $2.95**
CAT AV-6590
Only
$1ea

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Jaycar vifa

*FREE GOLD Speaker Stands For October

*Cable with JV20's

Assemble your own speaker kits using quality European VIFA drivers and save a fortune. Cabinets and crossovers are prebuilt. Simply screw the speakers in and solder the leads. See our 1995 catalogue for full details. Call into any store for a demo.

*Two sets of Gold Speaker Stands FREE (value $60) with JV40/JV60/JV100 speakers and cabinets purchase. *One set FREE (value $30) with JV80/JV110

Quote from Leo Simpson Silicon Chip On JV100's
This speaker really performs, with prodigious power handling and beautiful bass down to below 30Hz. But as well as power handling and extended bass response, the system is very satisfying in its handling of all types of music with a smooth midrange and very clean treble reproduction.

JV80 8" Subwoofer

Refer EA June 1995

Speaker Vifa M22WR CW-2115	$199.50
Polyswitch Cat RN-3472	$10.95
Cabinet Cat CS-2540	$139.00
TOTAL	$349.45

JV40 5" Three Way Speaker Kit

Refer EA September 1995

SPEAKER KIT Cat CS-2570	$489/PR
WITH CABINETS Cat CS-2572	$699/PR

JV60 6" Three Way Speaker Kit

Refer EA August 1995

SPEAKER KIT Cat CS-2560	$579/PR
WITH CABINETS Cat CS-2562	$849/PR

JV100 10" Three Way Five Speaker Kit

Refer Silicon Chip October 1995

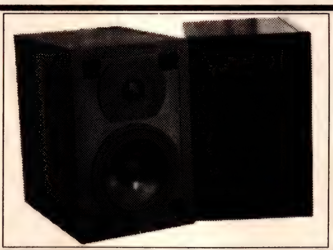
SPEAKER KIT Cat CS-2550	$1199/PR
WITH CABINETS Cat CS-2552	$1499/PR

JV20 2 Way Shielded Speaker Kit

FREE WITH $478 DEAL - 10 METRES OF MONITOR OFC SPEAKER CABLE Cat WB-1735 Value $39.50

Refer EA July 1995

SPEAKER KIT Cat CS-2580	$169.50/EA
WITH CABINETS Cat CS-2582	$239/EA - $478.00/PR



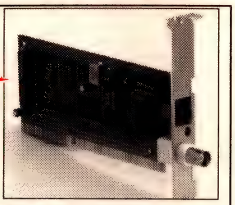
JV110 10" Subwoofer

SPEAKER - Vifa M26WR Cat CW-2118	$229.50ea
POLYSWITCH RN-3472	$10.95ea
CABINET Cat CS-2552	$149.00ea
BAFFLE Cat CS-2556	$30.00ea
TOTAL	$419.45ea

JAYCAR FOR ETHERNET

ETHERNET LOCAL AREA NETWORK CARD

NEW



ISA 2 in 1 Ethernet network interface cards (BNC and RJ-45 connectors). Novell NE2000 compatible Netwave ODI/IPX, NDIS & packet drivers. Bus width: 8/16 bit ISA, auto detection RAM buffer: 8/16K/bytes. Jumperless software configuration and hardware automatically detects media type. Ideal for Netware, Windows for Workgroup and Lantastic.

Cat. XC-4650 **was $79.95 NOW $69.95**

ETHERNET NETWORK CABLES WITH BNC PLUGS EACH END

NEW

5 metres	Cat. PL-0938	$9.95
10 metres	Cat. PL-0937	$16.95

CONNECTORS

BNC 50Ω Terminators	Cat. PP-0655	$3.95
BNC "T" Connector	Cat. PA-3662	$5.95
BNC Crimp Plug	Cat. PP-0649	$2.80
Boot For PP0649	Cat. PM0648	$1.25
"F" Connector double female	Cat. PA-3662	$5.95

MAKE YOUR OWN LEADS

50Ω Cable	Cat. WB-2010	$0.85m $60/100m
Crimping Tool	Cat. TH-1880	$39.95ea

CD ROM

NEW

Dual speed Japanes made CD ROM. 12 month warranty. Suitable for use with any IBM compatible machine. Supplied with CD ROM drive disk, leads and instructions.

Cat. XC-4625 **NOW $159 SAVE $40**

3.5" 1.44M Floppy Disk Drive

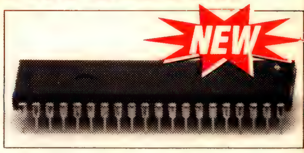
Quality brand
12 MONTHS GUARANTEE

Cat. XC-4620 **WAS $79.95**

NOW $69.95 SAVE $10

MICROPROCESSOR BARGAIN

NEW



INTEL P8086-2 16 bit HMOS CPU, 5mHz clock, 40 pin device, DIL.

Cat. ZZ-8510 **5 for $5**

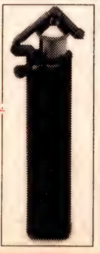
PROFESSIONAL ADJUSTABLE WIRE STRIPPER SELLOUT

NEW

Quality tool ideal for stripping coaxial cables. Will either strip in a circular motion or slice the sheath side ways. Simple cutting depth adjustment. If you strip a lot of cables, this tool is a must for your toolbox.

Cat. TH-1822 WAS $24.95

NOW $14.95 SAVE $10



360° Ceiling Mount Pulse Count PIR

NEW

Attractive slimline design giving 11 metre radius at 3.6m ceiling height - much easier to mount in certain situations, and cables can be easily run through house ceilings instead of down walls. •Operating voltage: 8 to 16VDC •Current draw: 15mA •Output: NC contacts •Tamper: NC •Pulse count: 1 or 2 selectable.

DONT PAY $69.95

Cat. LA-5020 **only $49.95**

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CAR SPEAKERS WITH 2 YEAR WARRANTY!!!

4" 2 Way
Cat. CS-2250
$37.95pr

6" 3 Way Rear
Cat. CS-2262
$59.95pr

See 1995 catalogue for full details - page 61.

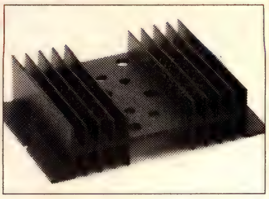
6" 3 Way Door
Cat. CS-2258
$48.95pr

6" x 9" 3 Way
Cat. CS-2268
$109pr

1/2 PRICE DRILLED HEATSINK

Drilled for 2 x T03. Size 102W x 72L x 23Hmm

CAT PRICE
$6.50
October
$3.25
HALF PRICE Cat. HH-8561

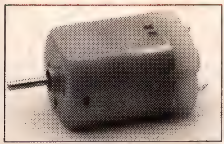


COMPONENT CARRY CASE

Includes carry case skeleton and 6 plastic cases. See our 1995 catalogue P124 for full details.

CAT PRICE $19.95
Oct $14.95
SAVE $5 Cat. HB-6345

12 VOLT HOBBY MOTOR SALE



Mabuchi brand. •Speed (no load) 5625 RPM •Current (no load) 31mA •Speed (max eff) 4200RPM •Dia 24mm •Length 35mm •Shaft Length 10cm •Dia 2mm. See 1995 catalog P188 for full details.

CAT PRICE $3.95
Oct $2.50
SAVE $1.45 Cat. YM-2710

GIFT VOUCHERS NOW AVAILABLE

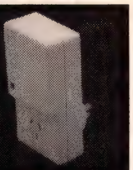
Gift vouchers are an ideal way to give a gift to someone. Simply purchase on for any amount you nominate, and the receiver can bring it to any Jaycar store to collect whatever he/she wishes to the value.

NEW MAINS FILTERS

Power Surge Protector

Protection by Metal Oxide Protectors. Similar unit was selling for $31. **Cat. MS-4010**

Only $19.95



Power Surge Line Filter

Will filter EMI and RFI. Protection by Toroidal Coil and MOV's **Cat. MS-4008**

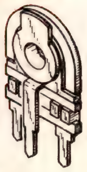
Only $49.95

Fibreglass Double Sided PCB Bargain

We have a limited quantity of these PCBs available. Size: 355 x 167mm. Normally these would cost around $10.

Cat. HP-9516 ONLY $5

10mm Trim Pot Madness



We are overstocked. These normally sell for 60¢ eac. Now only $2 for 10 of the same value.

STOCK UP NOW

Cat. No	Type
RT-4030	100 ohm
RT-4031	200 ohm
RT-4033	500 ohm
RT-4034	1k
RT-4035	2k
RT-4037	5k
RT-4039	10k
RT-4040	20k
RT-4042	50k
RT-4043	100k
RT-4044	200k
RT-4046	500k
RT-4047	1M
RT-4048	2M

$2 for 10
Of The Same Value

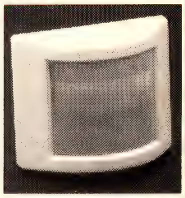
BUY 10 LESS 10%

JayTech Advanced Pulse Count PIR

AMAZING QUALITY FOR UNDER $30. Features Advanced Pulse Count - the latest in PIR's which virtually eleminates false alarms. •small size •SMT •supplied with bracket •shielded relay •lenses available

Only $29.95

Cat. LA-5025



Wide angle lens	**Cat LA-5026**	**$3.95**
Curtain / pet lens	**Cat LA-5027**	**$3.95**
Hall / long range	**Cat LA-5028**	**$3.95**

NEW KIT

Induction Loop TV Headphones Kit

REF: ELECTRONICS AUSTRALIA OCT 1995

An induction loop is a loop of wire mounted around a room, then connected to a TV set (or CD player) speaker. The TV drives the loop as though it were a speaker, and thus a fluctuating magnetic field with the same characteristics as the original audio signal is produced within the room. This kit is the pick-up unit into which mono headphones are connected. A great idea for those who may suffer from poor hearing. Case, PCB, ferrite and electronic components included. Use WB-1620 4 core cable for loop. 9V battery required use SB-2370.

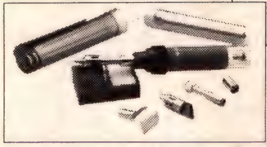
$19.95 Cat. KA-1779

HEADPHONES NOT SUPPLIED

THE LATEST KITS

Cat	Description	Price
KA-1778	Car low battery volt indicator	9.95
KA-1776	Parallel breakout box	45.00
KA-1775	Flexitimer Mk2	22.95
KA-1774	PC driven ECG	34.95
KA-1773	Economy surround sound	69.50
KC-5193	Vader voice Mk2	27.95
KC-5192	Railpower Mk2 train	125.00
KC-5191	Jacobs Ladder	29.95
KC-5190	Gain control mic preamp	29.95
KC-5189	Fuel injector monitor	49.95
KC-5188	Door minder	27.95
KC-5187	Electric fence	29.95
KC-5186	Train detector	13.95
KC-5185	Guitar headphone amp	29.95

HOT SOL SERVICE KIT



Don't buy tools you don't need with the Soldering Iron set! Includes: •1 x Hot-Sol Butane Gas Tool •1 x Protective Cap •1 x Non-slip stand with sponge •1 x Torch Tip which gives a flame •1 x 2.4mm Soldering Tip •1 x Hot Knife Tip •1 x Roll Solder •1 x Case which holds everything •1 x Hot Blow Tip for shrinking heatshrink tubing •1 x Scoop for feeding tubing to hot blow tip

Cat. TS-1702 only **$49.95**

SAVE $$ ON Jaycar RESPONSE 4Ω CAR SUB WOOFERS FOR OCTOBER

See our 1995 catalogue, or call for full details. These speakers will give excellent results at amazing low prices. All drivers are 4 ohm impedance and have rubber surrounds & huge magnets.

CS-2234

CS-2238

Size Inch	Cone Material	Power Handling	Box Size Vented	Box Size Sealed	Cat No.	Cat Price	October Price	Save $$$$
6"	Polycone	80WRMS	13LT	7.7LT	CS-2232	$49.50	$39.50	$10.00
8"	Polycone	120WRMS	25LT	20LT	CS-2234	$65.00	$52.00	$13.00
10"	Polycone	160WRMS	50LT	30LT	CS-2236	$99.50	$84.50	$15.00
12"	Polycone	200WRMS	105LT	67LT	CS-2238	$135.00	$115.00	$20.00

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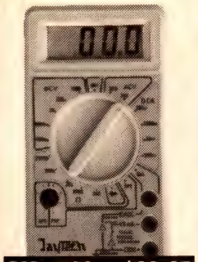
AMAZING VALUE DMM'S FROM JAYCAR

BRILLIANT RANGE OF MULTIMETERS ALL OFFER UNBELEIVABLE VALUE FOR MONEY

For full specifications and list of all the features associated with each model see our 1995 catalogue.

Low Cost

- 3.5 Digit 12.5mm High Display LCD
- Transistor Test
- Diode Test
- 10 Amp Current



QM-1500 $29.95

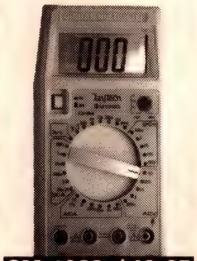
Pocket

- 3.5 Digit
- Wrap around leads
- Small size
- One hand operation
- Continuity • Diode

QM-1520 $34.95

30 Range

- Large Display
- Transistor Test
- 20 Amp
- Diode Test



QM-1300 $49.95

Temperature

- Frequency Transistor
- Diode, Continuity
- Capacitance
- Auto Power Off
- Large Display • 20 Amp

QM-1320 $69.95

Auto Range

- 3.5 Digit
- 1999 Count
- Data Hold
- Bargraph
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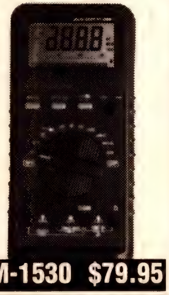

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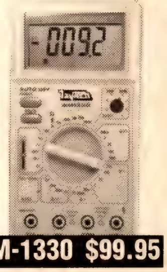

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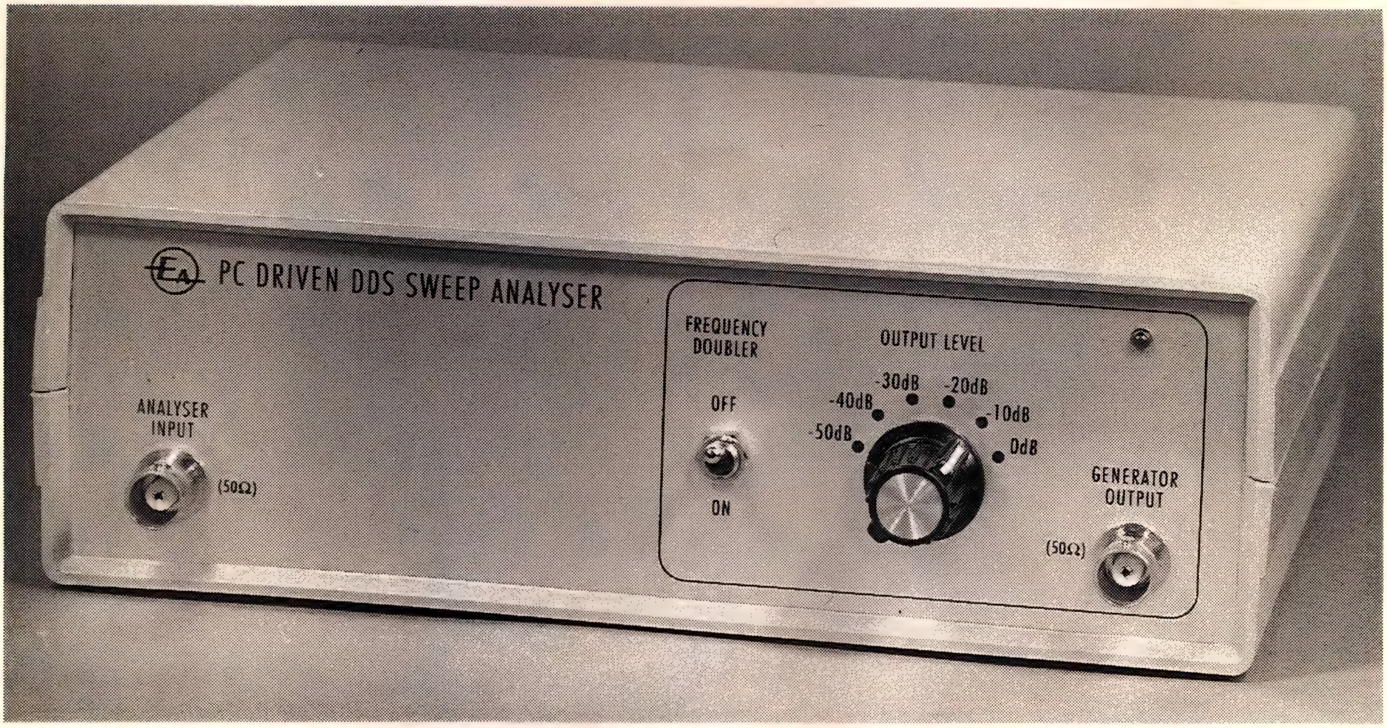
Using some locally designed modules to make



A PC-CONTROLLED SWEEP ANALYSER - 2

Here's the second of a short series of articles describing how to build some really useful PC-controlled test instruments. Here we show how to use the low cost DDS synthesiser and log detector/ADC modules presented last month to produce an RF signal/sweep generator and analyser, suitable for accurate testing of filters, amplifiers, RF/IF strips — and components such as inductors, crystals and ceramic resonators.

by JIM ROWE

Having last month introduced the low cost DDS synthesiser and log detector/ADC kit modules designed by Tibor Bece, and described the way they work, let's now look at how they can be used to produce a very handy PC-controlled RF signal/sweep generator and analyser.

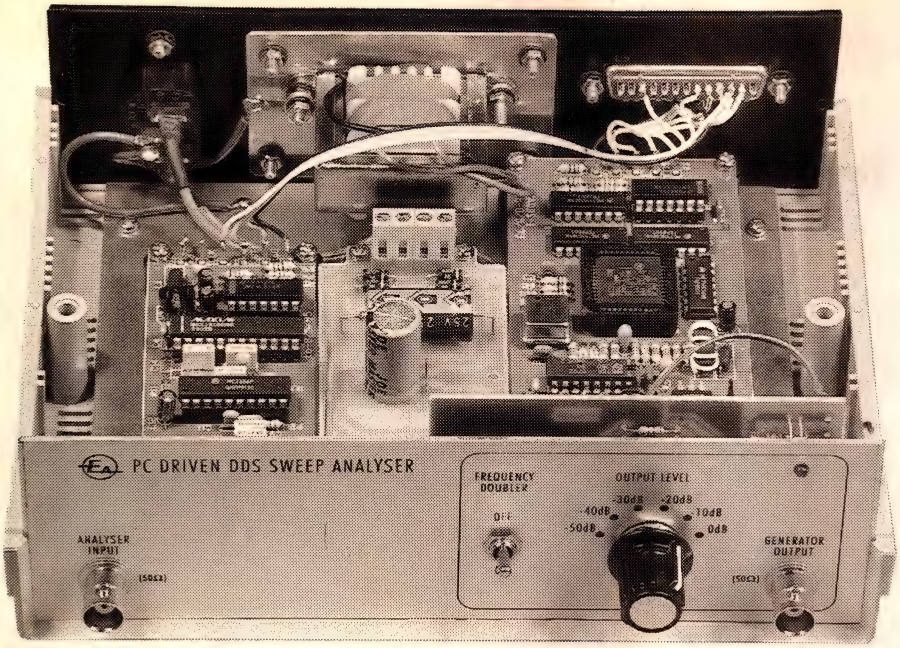
The instrument shown, and to be described, covers up to 21.5MHz on its fundamental output and up to 43MHz with the frequency doubler. The generator section has a nominal maximum output level of +2dBm (280mV RMS) into a 50-ohm load on fundamental, and -10dBm (70mV RMS) for the doubled output. It has a switched attenuator to reduce the output in 10dB steps, to a total of 50dB. The analyser section has an input impedance of 50 ohms, and can measure levels between -80dBm and -10dBm.

A calibration table built into Mr Bece's matching software allows the two to be used together for quite accurate sweep analysis of filters, amplifiers and other networks, while components can also be measured using simple external jigs and adaptors. For example, later in the article we'll be giving details of a simple adaptor which lets you measure not only the inductance of a coil, but its Q (quality factor) as well.

The DDS synthesiser and log detector/ADC modules form the heart of the RF sweep analyser, as you'd expect. They're simply augmented by a small frequency doubler/output attenuator board, and housed in a plastic utility case along with a power supply to provide the 12V DC needed by both modules.

Fig.1 shows the basic arrangement, and also shows the circuit of the power supply — along with the wiring between the modules and the DB25 plug J3, used to connect the sweeper to the printer port of the PC.

Note that the simple unregulated power supply shown is all that's needed for the sweeper, as both modules have on-board regulation of their own. As the total DC current drain is about 220mA, a transformer rated at 12V/500mA is used, along with a diode bridge and a single 2200uF reservoir capacitor (although two



Inside the case, Tibor Bece's DDS and detector modules are mounted on a shield plate with a power supply module between them. The power transformer is mounted on a small plate bolted to the rear panel.

1000uF units were actually used in the prototype unit pictured).

As you can see, the RF output of the DDS module passes through the circuitry on the auxiliary doubler/attenuator board, before reaching the RF output connector. Fig.2 shows the circuitry on the auxiliary board, which is logically divided into the frequency doubler and attenuator sections.

The frequency doubler section consists of a compact and low cost SBL-1 wideband double balanced mixer (DBM) module, together with DPDT switch SW2, used to either bypass it in the 'OFF' position, or connect it in circuit in the 'ON' position. The DBM is connected so that the RF signal from the DDS module is fed simultaneously to two mixer ports — forcing it to generate the second harmonic (fo + fo = 2fo) at the third port.

Note that the SBL-1 DBM is made by US manufacturer Mini-Circuits, and is available from that firm's Australian distributor Clarke and Severn Electronics, of Unit 2/107 Hunter Street (PO Box 1), Hornsby NSW 2077; phone (02) 482 1944, or fax (02) 482 1309. The quoted price in single quantities is $9.50 plus $5.00 for packing and postage within Australia.

The attenuator section of the board consists of a six position two-pole rotary switch, selecting either a straight-through path (in the 0dB position) or one of five 'pi section' 50-ohm attenuator pads, providing either 10dB, 20dB, 30dB, 40dB or 50dB of nominal attenuation. The resistor values used are all readily available in the E24 range stocked by most suppliers, and give attenuation values very close to the nominal figures when feeding a 50-ohm load.

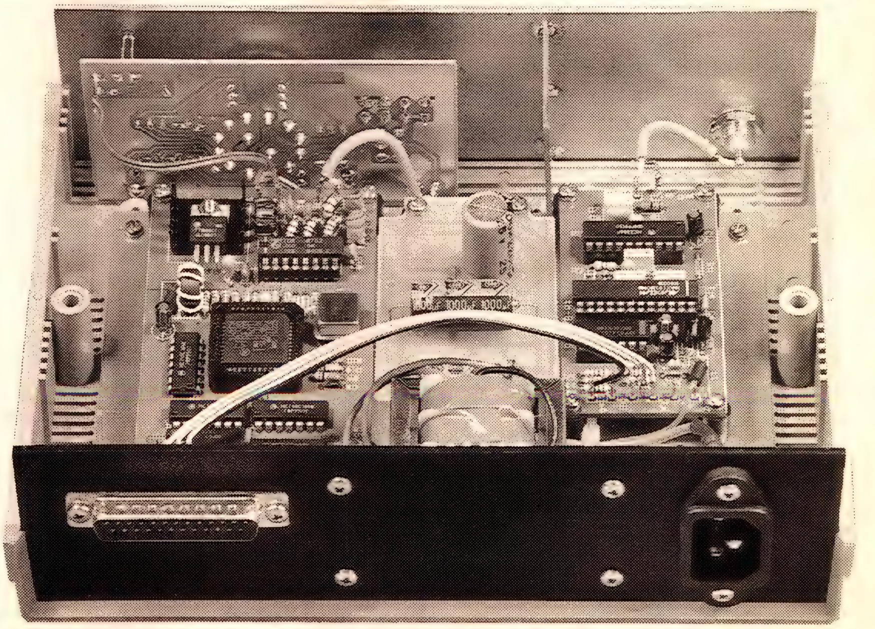
All of the circuitry shown in Fig.2 fits on a PC board measuring 94 x 50mm, and coded 95swa9. The PCB mounts directly on the rear of the rotary switch and toggle switch, and is supported by them behind and parallel with the case front panel. In this case the front panel itself is made from a piece of blank PCB laminate, cut to the same size as the usual plastic front panel and fitted with the copper side facing inwards. The copper surface is connected to signal earth via the BNC connectors and cabling, so that the panel doubles as a shield.

The PCB pattern for the doubler/attenuator board is shown in Fig.3, while Fig.4 shows the overlay diagram to help you in wiring the board up.

As the pins of the rotary switch may have to be bent slightly to align them with the corresponding holes in the PCB, you may find it convenient to do this first, before fitting any of the other components to the PCB. Then with the two assembled and the pins soldered to the PCB pads, the two can be handled together as an item for the fitting of the remaining parts. Most of the remaining components are 1/4W resistors, apart from the toggle switch, SBL-1 mixer and power indicator LED.

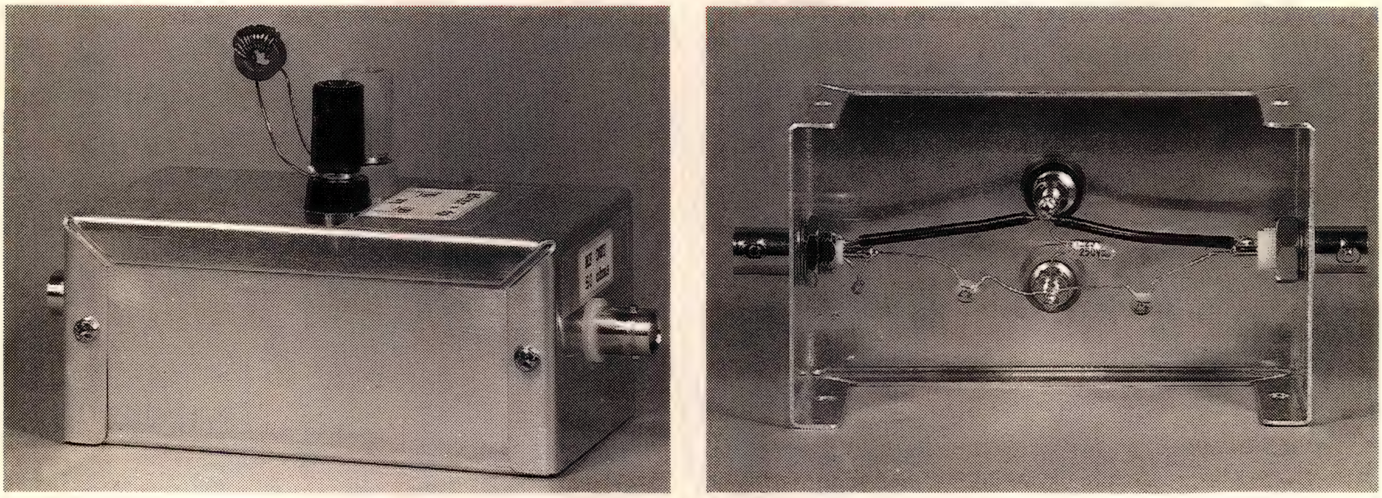
It's probably easiest to mount the miniature toggle switch directly on the PCB via its pins, in the same way. Then when the finished assembly is offered up behind the front panel, it's fairly easy to line up the two switch ferrules with the holes in the panel. The small nuts and washers provided with the toggle switch can be used to adjust its panel-board spacing to match that of the rotary switch.

Note that the BNC socket used for the generator output is not mounted on the doubler/attenuator PCB, but mounts on the front panel with short lengths of 1mm tinned copper wire used to connect it to the PCB pads when the switch/PCB assembly is mounted in place behind the panel. The wires are soldered to the socket lugs after it is mounted on the panel,



The original plastic front panel is replaced by a piece of unetched copper laminate, to provide additional shielding. The doubler/attenuator board is supported behind the panel by the rotary and toggle switches.

A PC controlled Sweep Analyser - 2



Two views of the small adaptor box which can be used to allow convenient measurement of inductors using the new sweep generator. It's built inside one of the smallest aluminium utility cases, and uses only a handful of components.

and dressed so that they pass through the correct PCB holes when the switch/PCB assembly is fitted behind it.

The soldering to the PCB pads is the final step. (Note that another short length of 1mm tinned copper wire should be used to connect the earthy side of the BNC socket reliably to the copper of the front panel, before the switch/PCB assembly is fitted.)

Also the power LED should not be fitted to the PCB until the board assembly is being fitted to the panel, because otherwise it's too hard to fit it squarely and with the correct lead length. Just before the PCB assembly is mounted on the panel, the LED body can be pressed into a snug 3mm hole in the panel and its leads fed through the holes in the PCB pads, as the assembly and panel are being mated. Then after the switch nuts are tightened the LED leads can be soldered to the pads, automatically achieving the correct LED positioning and support.

Note that the remaining connections between the doubler/attenuator PCB and the rest of the sweeper circuitry will be easier if you fit four terminal pins to the PCB — two near the LED for its 12V DC supply, and two in the diagonally opposite corner for the RF input from the YADDS-1 module. For convenient soldering when the panel and PCB are in position, the pins should be fitted to the *copper* side of the PCB.

Most of the components for the sweeper's power supply are mounted on a small PCB (75 x 45mm) which was designed by James Barker, and is being described separately. The PCB is designed to suit a variety of power supply configurations, but in this case it's used

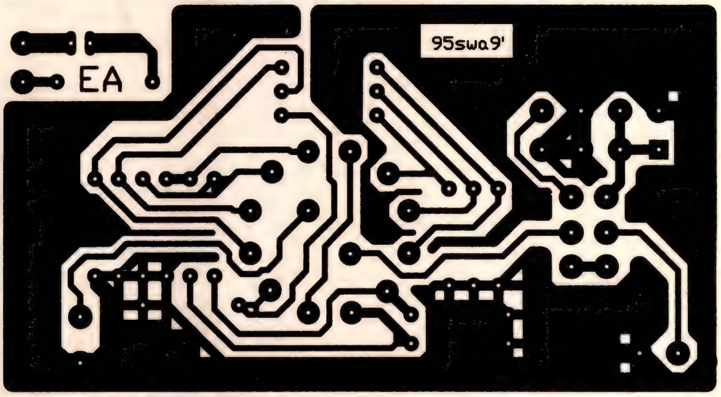


Fig.3: The etching pattern for the doubler/attenuator board, shown here actual size as usual for those who etch their own boards.

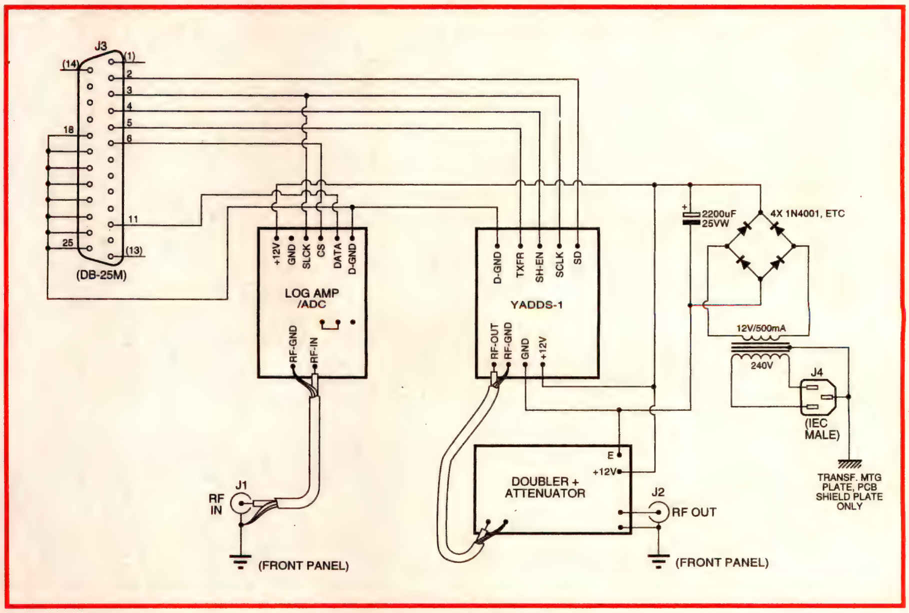


Fig.1: The wiring diagram for the sweep generator, showing also the very simple power supply circuit used. Follow these connections carefully to ensure that the instrument gives the best performance.

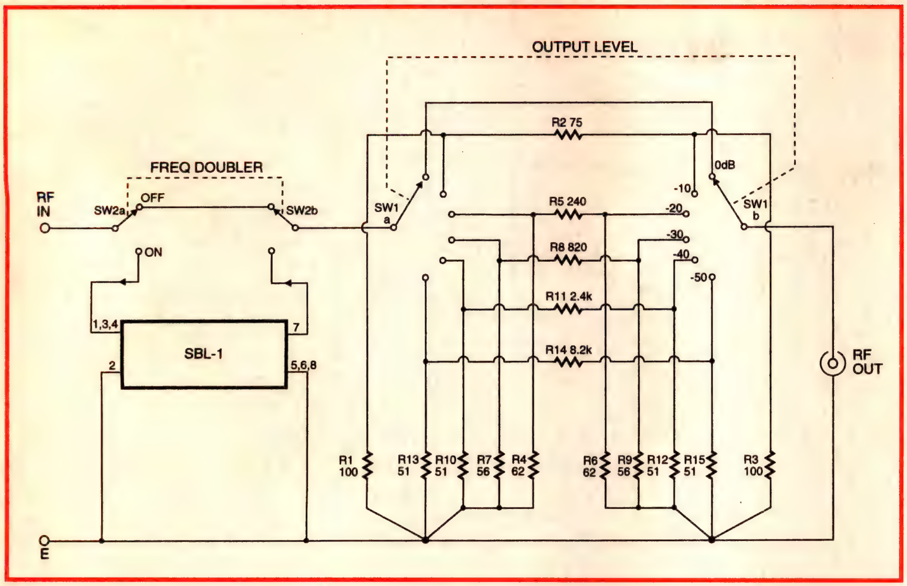


Fig.2: The schematic for the frequency doubler and output attenuator section of the circuit. All of the components shown are mounted on the small vertical PCB.

merely to support the bridge diodes and reservoir electrolytic.

The small 12V/500mA power transformer is mounted securely on a small rectangle of 1mm-thick aluminium plate, bolted in turn to the plastic rear panel. This not only supports the transformer properly, but also allows both the transformer frame and mounting plate to be connected reliably to mains earth, for safety in the event of transformer overheating, etc. The mounting plate measures 78 x 48mm, and two countersink-head 3mm x 10mm machine screws with nuts and star lockwashers are used to mount the transformer securely to it. Four cheese-head 3mm x 10mm machine screws are then used to mount the transformer/plate assembly inside the rear panel.

Also mounted on the rear panel are the DB-25 plug used to connect to the PC printer port (via a DB-25 extension cable), and an IEC captive mains plug.

As you can see, the YADDS-1, detector/ADC and power supply PC boards are mounted via 10mm-long insulating pillars on a shield plate, which is in turn attached to the bottom half of the case via self-tapping screws. The shield plate measures 169 x 115mm, and in the case of the prototype sweeper shown it is made from blank PCB laminate. Alternatively you could use 1mm aluminium plate, if you prefer.

Either way, the shield plate should be reliably connected to mains earth at the IEC connector, along with the transformer mounting plate and frame. In the prototype shown these earth connections

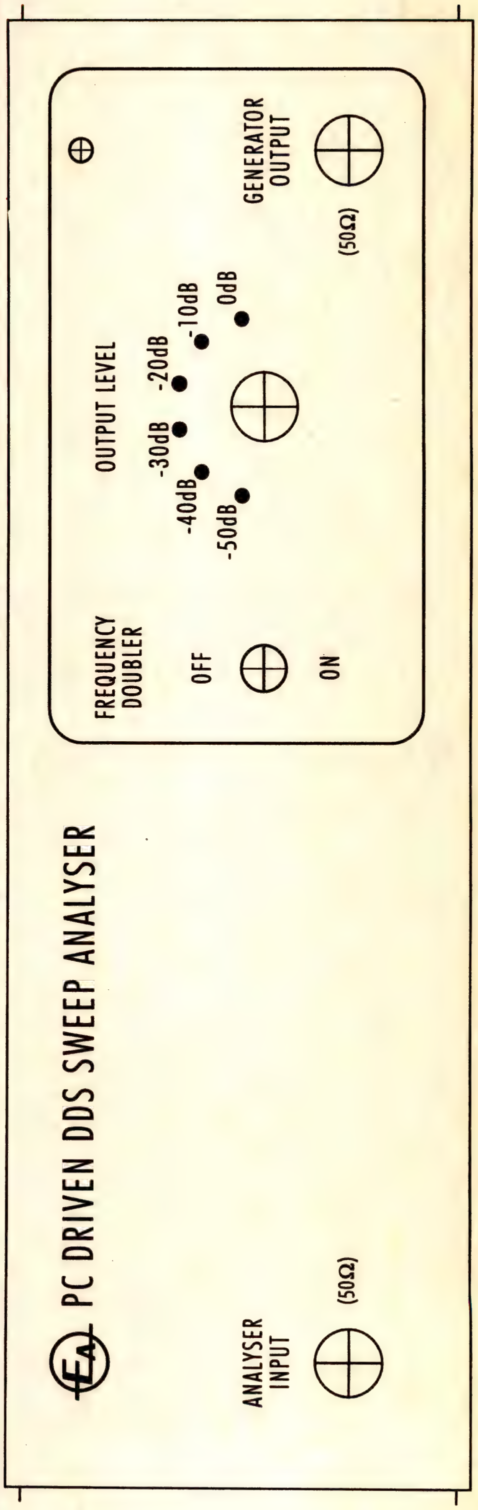


Fig.5: The front panel artwork for the sweep generator, shown here actual size, again for those for who make their own using either Dynamark photosensitive aluminium sheet or a photocopier.

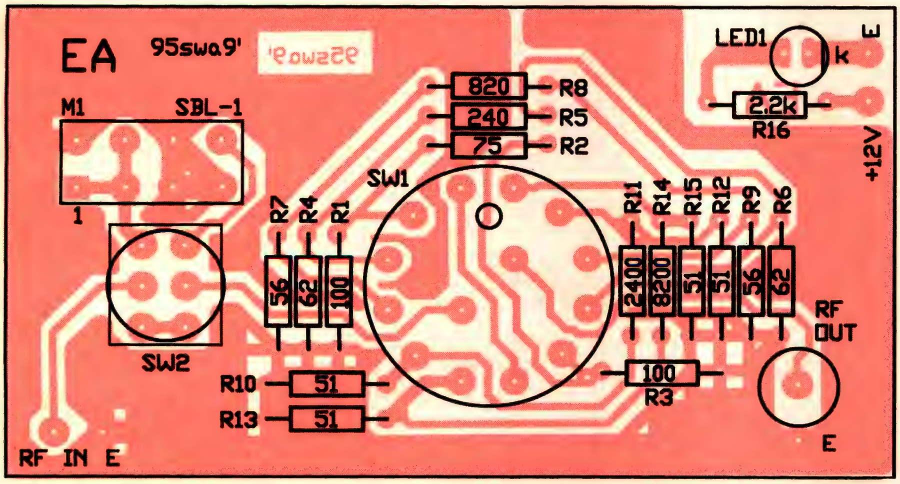
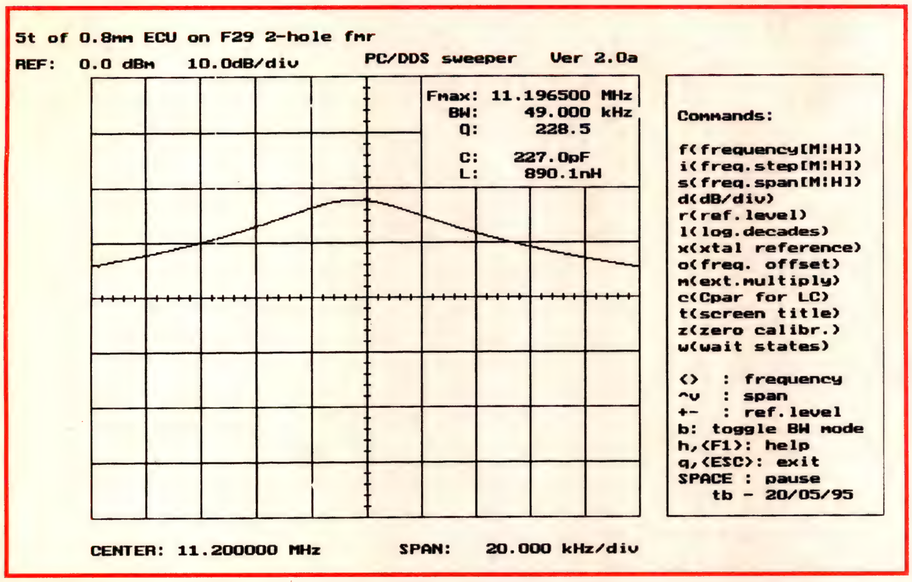


Fig.4: And here is the overlay diagram for the doubler/attenuator PCB, to guide you in wiring it up. Take care with the orientation of the frequency doubler module M1 (SBL-1), and also the LED.

A PC controlled Sweep Analyser - 2



```
5t of 0.8mm ECU on F29 2-hole fmr
REF:   0.0 dBm    10.0dB/div          PC/DDS sweeper    Ver 2.0a

                          Fmax: 11.196500 MHz
                            BW:     49.000 kHz
                             Q:      228.5

                             C:    227.0pF
                             L:     890.1nH

Commands:

f(frequency[M:H])
i(freq.step[M:H])
s(freq.span[M:H])
d(dB/div)
r(ref.level)
l(log.decades)
x(xtal reference)
o(freq. offset)
m(ext.multiply)
c(Cpar for LC)
t(screen title)
z(zero calibr.)
w(wait states)

<>   : frequency
^v   : span
+-   : ref.level
b: toggle BW mode
h,<F1>: help
q,<ESC>: exit
SPACE : pause
    tb - 20/05/95

CENTER: 11.200000 MHz          SPAN:    20.000 kHz/div
```

Fig.6: This screen dump, made using Pizzaz Plus, gives a good idea of the display produced by Tibor Bece's SWEEPER.EXE program. The small panel visible in the upper right hand corner of the graticule appears when you toggle the program into band width and inductance measuring mode.

are made using two short lengths of green/yellow insulated mains cable wire, one soldered directly to the shield plate and the other to a solder lug mounted firmly to the nearest transformer mounting bolt, using an additional nut and star lockwasher.

Note that the 'signal earth' of the sweeper is NOT connected directly to this 'safety earth', to prevent possible earth loop currents and complications when the sweeper is connected to the PC. That's why the PCBs are mounted to the shielding plate using insulated pillars...

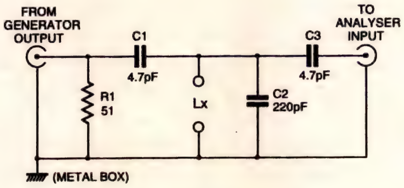


Fig.8: The schematic for the inductance measuring adaptor. As you can see, it's very straightforward.

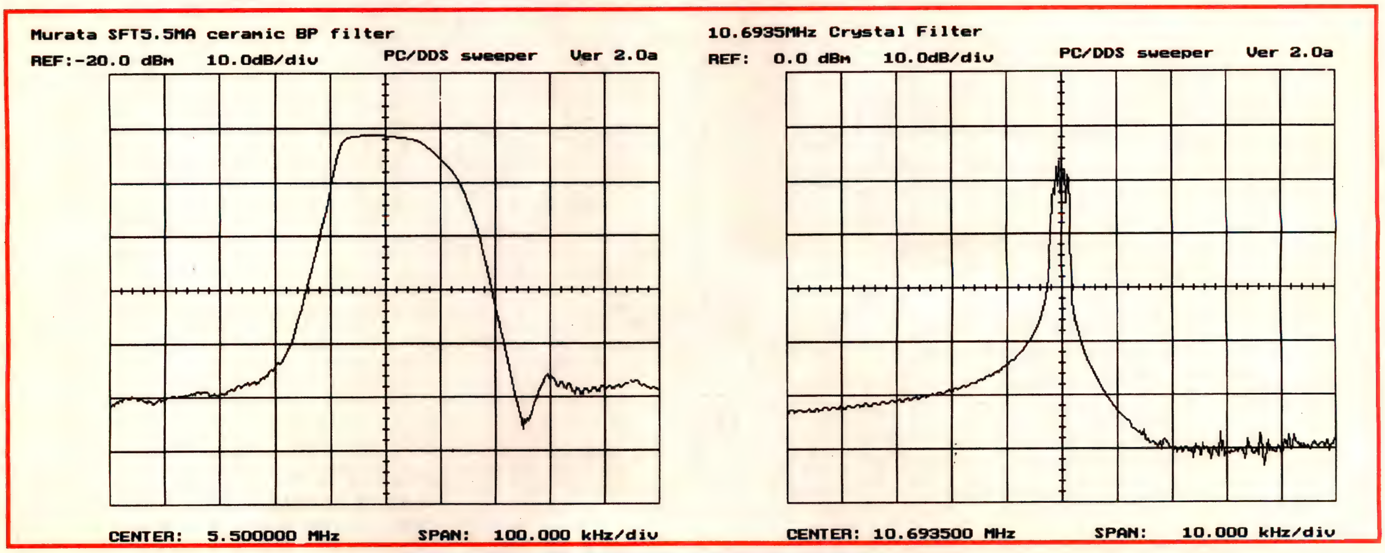
Of course the copper of the PCB laminate front panel and the RF input and output connectors *are* connected to the *signal* earth, at the earthy sides of the RF connectors. The RF output connector then links back via the doubler/attenuator PCB to the earth of the YADDS-1 module, while the RF input connector links directly to the input of the detector/ADC module via a short length of shielded cable or 50-ohm coax.

Returning to the mains wiring for a moment, the flying leads from the transformer primary connect directly to the 'A' and 'N' lugs of the IEC plug. But don't forget to sleeve these connections properly, to prevent accidental contact. Use either 'heatshrink' sleeving or varnished cambric of suitable diameter, pushed fully over the lugs, soldered joints and any bared conductor.

That's about it for the basic RF sweeper construction. The connections between the modules and the DB-25 plug are shown in Fig.1, and as you can see they're quite straightforward.

As you can see, the front panel artwork for the sweeper is reproduced in Fig.5 actual size, to assist those who'd like to make their unit look like the prototype shown.

About the only item I haven't mentioned yet is the small vertical shield plate you may have noticed in the internal pictures, soldered to the rear of the front panel just to the side of the detector/ADC module, on the side nearer the doubler/attenuator board. This was found to reduce a tiny residual level of capacitive 'leak through' from the generator circuitry to the detector front end at high frequencies, and allowed the full dynamic range of the sweeper to be achieved. The shield measures 42 x 35mm, and is arranged so that it clears the horizontal shield plate (which is



```
Murata SFT5.5MA ceramic BP filter
REF:-20.0 dBm    10.0dB/div          PC/DDS sweeper    Ver 2.0a

CENTER:   5.500000 MHz          SPAN:   100.000 kHz/div
```

```
10.6935MHz Crystal Filter
REF:   0.0 dBm    10.0dB/div          PC/DDS sweeper    Ver 2.0a

CENTER: 10.693500 MHz          SPAN:    10.000 kHz/div
```

Fig.7: Two further screen dumps showing the kind of sweep plots which can be achieved using the generator. At left (a) is the response of a 5.5MHz ceramic bandpass filter while on the right (b) is that of a 10.6935MHz crystal filter.

connected to mains earth, you'll hopefully recall).

Oh — a minor correction. Last month, in the schematics and overlay diagrams for the YADDS-1 and detector/ADC modules, we showed the resistors used to isolate digital and analog circuit earths on each PCB (R20 on the YADDS-1, R9 on the ADC module) as each having a value of 10 ohms. Tibor Bece has since advised that this value is too high; for best results, both resistors should be reduced to 1.0 ohm.

Sweeper checkout

Once the sweeper is complete, the main thing to check is your own wiring — particularly things like the connections between the power supply and the modules. Applying the DC with reverse polarity can cause considerable damage, and could be rather costly; so check this carefully before applying the power.

If all seems well, apply the power and quickly check the DC voltage at the '+12V' pin of each module. With a nominal 12V transformer it will read higher than +12V, and probably about 14 - 15V (depending upon the exact mains voltage and the regulation of your transformer).

That's OK — as long as it's between about 12V and 18V DC, the modules will operate correctly and the regulator chips won't overheat.

You should now be ready to fit the top to the sweeper case, connect it up to a spare printer port on your PC, and put it to work.

Putting it to use

With the software developed by Tibor Bece, the sweeper can be used for a wide variety of RF measurements. For example with the DDS.EXE program you can use the generator section as a fixed frequency signal generator, with the output frequency easily programmable from the PC keyboard.

Similarly by means of the LEVEL.EXE program you can use the detector/ADC section as a wideband logarithmic detector, displaying the level of an incoming RF signal on the PC's screen. Using the ADC.EXE program, you can also use the ADC module as a high-resolution (1mV steps) 0-4V DC voltmeter, if you wish, by bringing out the ADC input directly from the module — perhaps fitting a switch to allow selection of either this direct input or the log detector 'front end'.

Of course it's Mr Bece's SWEEPER.EXE program that really lets you use the two sections of the sweeper together to achieve its full potential, as a sweep analyser to measure the response of an IF/RF amplifier, filter or other circuit over a range of frequencies. This program is very flexible, giving you the ability to control virtually all testing and measurement parameters easily, quickly and conveniently.

SWEEPER.EXE displays the swept response of a circuit or component directly on the screen, as you can see from the sample screen dumps of Figs.6 and 7. The display is fully annotated in terms of centre frequency, frequency span (kHz/div or MHz/div as appropriate) and vertical calibration (both the reference level in dBm represented by the top of the graticule, and the dB/div). It also has a 'help' window which can be optionally displayed on the right-hand side of the display graticule (see Fig.6), and provision for you to not only change any of the settings easily, but also add comment text (such as a response curve label) at the top left of the screen.

By the way the program and hardware can perform both linear and logarithmic sweeping, as desired. With log sweeping you can select any span between 0.1 and 4.9 decades, with '0' being used to obtain linear sweeping. It can also be set for linear vertical display instead of logarithmic, by setting the 'dB/div' parameter to '0' as well.

Although SWEEPER.EXE doesn't itself offer printing or sweep plot saving and re-loading facilities, these functions are easily performed using a screen capture utility such as Pizazz Plus. That's how the screen dumps shown here were produced, in fact.

A particularly nice feature built into SWEEPER.EXE is the ability to measure the resonant frequency, bandwidth and Q (quality factor) of tuned circuits — plus the value of an inductor in a tuned circuit, knowing the value of the capacitor. These features are enabled simply by pressing the 'b' key (to toggle the program into and out of bandwidth mode) and by feeding in a value for the resonating capacitor.

Not surprisingly, in order to measure the resonant frequency and bandwidth of a circuit or network, the program and sweeper must be set so that the circuit's transfer function 'peak' is being displayed on the screen.

You must also be displaying enough of the response curve to include the -3dB points as well, so that it can determine the bandwidth. Providing these requirements

SOFTWARE AND KIT AVAILABILITY

As advised in the first of these articles, Tibor Bece the designer of the YADDS-1 and detector/ADC kit modules used in the sweeper project has written a number of matching software programs to facilitate their use. Included in the software are simple driver programs such as DDS.EXE, to control the frequency, frequency step and offset of the YADDS-1 module; ADC.EXE, to fetch readings from the ADC module and display them on the screen; and LEVEL.EXE, to test the ADC module's calibration.

Mr Bece has advised that all of this software, with the only exception of his more elaborate SWEEPER.EXE program, can now be placed on our computer BBS for convenient downloading by any interested *EA* reader. As a result, you'll find the programs in a compressed file called **YADDSDRV.ZIP**, in the 'EA Project Software' area of the BBS.

For readers who do not have the facilities to access the BBS, we can alternatively supply the programs by mail via our Reader Information Service.

Simply send in a formatted (MS-DOS) floppy disk, together with a fee of $5.00 to cover copying and return postage, and we'll return your disk with the files.

As this basic 'get you going' software is now readily available in this way, Mr Bece will no longer be supplying it on floppy disk with the individual module kits.

Note, however, that because development of his program SWEEPER.EXE involved a lot of work, Mr Bece has not unreasonably elected to retain proprietary copyright to it. This program will therefore only be available directly from him, for a cost of $39 if purchased separately, or only $10 if purchased together with the complete kits for both of his modules.

As mentioned last month, the kits and software can be ordered from Tibor Bece at PO Box 1379, Sunnybank Hills, Queensland 4109.

The complete module kits are priced at $99 for the YADDS-1 and $69 for the ADC, but Mr Bece is prepared to sell 'short form' IC kits for $70 and $45 respectively, and also the PCBs alone for $25 and $20 respectively.

Note that the short form kits do not include the PCBs.

A PC controlled Sweep Analyser - 2

PARTS LIST

Doubler/Attenuator:

Resistors

(All 0.25W 1% metal film)

R1,3	100 ohms
R2	75 ohms
R4,6	62 ohms
R5	240 ohms
R7,9	56 ohms
R8	820 ohms
R10,12,13,15	51 ohms
R11	2.4k
R14	8.2k
R16	2.2k

Miscellaneous

M1	SBL-1 double balanced mixer
SW1	2 pole 6-position rotary switch
SW2	DPDT miniature toggle switch PCB tails
PCB	94 x 50mm, code 95swa9
LED1	3mm red LED
Four	PCB terminal pins

Case, power supply:

1	Plastic utility case, 200 x 160 x 65mm
1	YADDS-1 DDS generator module (see box)
1	Detector/ADC module (see box)
1	12V/500mA power transformer
1	Power supply PCB, 95ps9 (RCS Radio)
4	1N4001 or similar diodes
1	2200uF 25VW electrolytic capacitor
2	BNC socket, single hole panel mount
1	IEC mains plug, panel mount
1	DB-25 plug, panel mount

Transformer mounting plate, 1mm aluminium, 78 x 48mm; shield plate, 1mm aluminium or blank PCB laminate, 169 x 115mm; substitute front panel, blank PCB laminate 194 x 62mm; 42 x 35mm piece of blank PCB laminate for shield; 1 x instrument knob; 12 x 10mm insulated spacers, with screws and lockwashers; 2 x 10mm long, 3mm countersunk head machine screws; 8 x 10mm long, 3mm cheese head machine screws; 11 x 3mm nuts, star lockwashers. Short lengths of connecting wire, coaxial cable, etc.

are met, it automatically displays the peak frequency Fmax, the bandwidth BW and the calculated effective Q (which is generally that of the inductor).

If the circuit concerned is a parallel resonant LC combination, and you know the capacitance, it will also calculate and display the coil inductance. This makes it particularly useful if you're winding your own coils for various projects, or need to accurately measure commercially sold inductors for use in filters, etc.

Inductance adaptor

To take full advantage of this facility, Tibor Bece has designed a simple inductance measuring adaptor for use with the sweeper. It uses only a handful of parts, and everything fits inside one of the smallest aluminium utility boxes (100 x 60 x 45mm).

The circuit for the adaptor is shown in Fig.8, and as you can see it's very straightforward. Resistor R1 provides a 51-ohm termination for the cable from the generator, while capacitors C1 and C3 provide a high impedance 'top coupling' into and out of the tuned circuit formed by C2 and the inductor under test (Lx). The output is then taken to the sweeper's analyser input.

The construction of the adaptor is shown in the photographs. BNC sockets at each end of the box are used for the RF input and output, with a pair of high-quality terminals at the top of the box for convenient connection of test inductors. R1 is wired directly across the RF input socket lugs, while C1 and C3 (ceramic NPO types) are wired between each BNC socket 'active' lug and the active inductor terminal. Resonating capacitor C2 is wired directly across the test terminals, and should be a polystyrene type for high stability and very low losses.

Note that the 'earthy' test terminal should be wired to the earth lug of each BNC socket using multi-strand wire, as shown. The aluminium box should also be connected to the earth lug of one socket, so that it provides reliable shielding.

For the most accurate results when the adaptor and sweeper are used to measure inductors, the best approach is to use a digital capacitance meter to measure the exact effective capacitance across the test terminals, once the adaptor is completed.

Do this with a 50-ohm terminating load attached to each BNC socket, to get the most accurate figure. (I used a couple of the low cost termination plugs, sold for use in LANs.) Then the measured capacitance figure can be marked on the adaptor, as a reminder, and also fed into SWEEPER.EXE when you want to measure an unknown inductor.

Following this approach, you can make fast and surprisingly accurate measurements of inductors.

And of course as well as allowing you to measure an inductor's value, SWEEPER.EXE also shows its Q — again quickly and simply. I've been doing this with the prototype unit shown for some weeks now, and it's proved very handy indeed.

There's one little point to bear in mind, though. When you're measuring the Q of an inductor, you get the most accurate results when the sweep span is adjusted so that the resonant peak is 'spread out' over a reasonable proportion of the overall graticule width.

This gives the software enough sampling resolution to perform its calculations accurately. If you have the span too wide, and the resonant peak is squeezed down to a very thin 'spike' in the centre, there won't be enough samples in the critical peak region for it to measure the bandwidth accurately. Often you'll get an artificially (and absurdly) high calculated Q figure...

Of course you can't spread the peak out *too* far either, or the displayed section of the curve may not include the -3dB down points — which will again give an incorrect reading. However it's quite easy to make sure you're not falling into this trap; just check the displayed curve against the centre vertical scale, to make sure you can see beyond the -3dB point on each side of the peak.

Other components

Finally, a few quick points about using the sweeper to check other components. To check ceramic filters, terminate the cable from the sweeper's generator output with 51 ohms and use a series resistor of between 1k and 2.2k to drive the filter input. Then use a similar value series resistor from the filter output to the analyser input. Most ceramic filters are designed to work with source and load impedances of about 1.5k.

To check crystals, simply terminate the cable from the generator output with 51 ohms, and connect the crystal in series to the analyser input.

To check crystal filters, terminate the generator cable with 51 ohms and use either capacitive divider matching to the filter at each end (series trimmer 500pF-5nF, parallel trimmer 30pF across filter input/output), or a tapped LC circuit at each end. Good shielding is important to preserve the filter attenuation characteristic — the sweeper can display an 80dB range. As you can see, the RF sweeper system can be used to carry out a wide range of measurements. You should find it a very worthwhile addition to your arsenal of test instruments.

In the next article, we'll be showing how to use Tibor Bece's modules to make up an equally useful sweeper for accurate *audio* testing. Stay tuned! ❖

SHORTWAVE LISTENING

with
Arthur Cushen, MBE

France plans expansion at Radio Tahiti

Most shortwave listeners are aware of Radio Tahiti on three frequencies, but know little about broadcasts in these islands of the South Pacific which are very much in the news at the moment.

The major broadcasting service, Radio France Overseas, is controlled by the French Government and is part of the Radio France International organisation based in Paris. This in turn, has extensive shortwave facilities in Europe, South America and Africa. RFO is responsible for Government backed broadcasting in French departments and territories scattered throughout the world.

The broadcasting scene in Tahiti has been turned upside down, just like in France, with the advent of private stations. On the FM band you will find many of the major French commercial networks, but there is only one station that broadcasts on FM, mediumwave and shortwave — and that is RFO. The studios are located in downtown Papeete, a city with 70,000 inhabitants, and work has begun on a new RFO studio building on the outskirts of Papeete. RFO Tahiti is different to most French stations overseas as it does cater for the local langugage, Tahitian.

Radio Tahiti operates 24 hours a day, with local programming from 5am to 9pm local time or 1500 - 0700UTC. At the weekends programmes are extended to 11pm local time or 0900UTC. Broadcasts are on mediumwave 738kHz and shortwave frequencies 6135, 11,825 and 15,175kHz. The news on the hour every hour is carried from a key station in France.

The satellite link to Paris has improved the quality of the signal and listeners appreciate this modern advancement in communications.

Bilingual programming

French Polynesia is bilingual and Radio Tahiti reflects that. Tahitian language broadcasts are mainly confined to the afternoon programming.

RFO, with its dual language broadcasts, has captured the major audience of radio listeners in Tahiti. A survey indicated they have the largest audience and are more popular than any of the thirty or so private stations in Tahiti. The survey indicated that another reason for Radio Tahiti's popularity was a better news service, both local and international.

Radio Tahiti employs a staff of 30, and six of them work in the news room for both radio and television. The television operation has over 100 employees and has been in operation for the past 27 years, set up by General Charles DeGaulle who promised them there would be no licence fee for radio and television. In 1962 General DeGaulle moved the French atomic testing programme from Algeria to Tahiti and since then there have been over 175 controlled nuclear explosions — to the great irritation of New Zealand and Australia.

French Polynesia covers an area as large as Europe, with islands scattered across the Pacific. Most of them are small and generally they only have an air service once a week. Those on the islands look for weather forecasts and the message service — which is a personal one, passing on messages to families from outlying islands to those living in Papeete. The messages are received through the mail or by phone and as well, Radio Tahiti has correspondents in outlying islands to enable them to give a comprehensive news service.

The new offices under construction for Radio Tahiti are expected to open this year and RFO is also keen to upgrade its transmitters, many of which have been operating since the last 1930's. The station appreciates reception reports from listeners and mail is received from many parts of the world — in particular Europe, where the reception of Radio Tahiti is a real challenge to the DX listener, according to a Radio Nederland correspondent who visited the area.

Higher power

The Voice of Turkey uses five transmitters on shortwave, three being of 250kW and two 500kW. At the moment broadcasts are in 15 languages, which will increase when a further five 500kW transmitters are added in the next few months. This will also mean an increase in duration of certain languages. The present English schedule is 1330 - 1400 on 9675kHz, 2100 - 2200 on 9730kHz, 2300 - 2400 on 7185/9445/11,710kHz and 0400 - 0500 on 9445kHz.

New BBC relay

The BBC is building a new shortwave relay station 12km north of Nakhon Sawan, Thailand. The transmitter is being built in cooperation between the BBC World Service and the Government of the Kingdom of Thailand. It is aimed at improving BBC World Service audibility for more than 40% of the world's population.

"This new relay station is crucial to the BBC's broadcasting plans for Asia, and the agreement is designed to bring important benefits to Thailand too," said Bob Phillis, Deputy Director-General of the BBC and Chairman of BBC Worldwide, according to ABU News.

The US$18.7 million relay station with four 250kW transmitters will serve large parts of South Asia and China. When fully operational it will carry BBC radio broadcasts in up to ten languages, including English, and reach potential radio listeners everywhere from Bombay to Beijing.

As part of the overall agreement, BBC World Service is supplying a broadcast training package for the Public Relations Department and Radio Thailand. ◆

AROUND THE WORLD

CROATIA: Zagreb is heard in English from 0400 - 0409UTC and according to a verification, 5895kHz has a power of 10kW and 7370 has a power of 100kW.

ECUADOR: HCJB's broadcast to the South Pacific heard at 0700 - 1130UTC has dropped 6135kHz and in its place is using 5900kHz. The reason for this change is to protect the Bolivian signal on 6135kHz.

GERMANY: Universal Life, 97070 Wurzburg uses transmitters of The Voice of Russia and verifies with a card and letters. The latest schedule shows 1930 - 2000UTC Sunday to Europe, Africa and the USA on two medium frequencies and 20 shortwave frequencies. Some of those shortwave frequencies in operation include: 7230, 7350, 9480, 9620, 11,675 and 15,015kHz.

JAPAN: Radio Japan has made the following frequency changes: 0100 - 0700, 11,790kHz replaces 9680; 0500 - 0800, 11,725kHz replace 11,955kHz; 2100 - 2400UTC, 9675kHz replaces 9580kHz.

PAKISTAN: Radio Pakistan, Islamabad has low speed news in English at 0230 - 0245 on 17,725kHz and 21,730kHz. From 1600 - 1630 the station has English news and low speed news on 7425, 9485, 11,570 and 13590kHz. Then follows 30 minutes in Irdu to sign off at 1700.

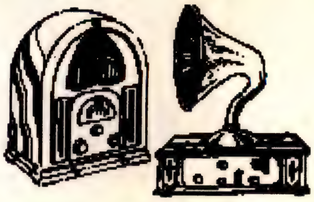
PHILIPPINES: The Voice of the Philippines has a daily broadcast in English which is a relay of the Philippines Broadcasting Service 0230 - 0330 on 17,865kHz and 21,580kHz. The transmitter is owned by the VOA. The frequency of 21,580kHz is a good signal, while 17,865kHz is blocked by Radio Australia.

THAILAND: Radio Thailand, Bangkok gives its full English schedule as 1900-2000 on 7200kHz; 2030 - 2045 on 9555kHz; 0000 - 0030 on 9690kHz; 0030 - 0100 on 15,370kHz; and 0300 - 0330 also on 15,370kHz. The last two broadcasts are to the east and west coast of North America, and the transmitter is 500kW at the Udon relay site.

VANUATU: Vila has been heard on the new frequency of 4960kHz, opening at 1900UTC and suffering from interference from Beijing on the same frequency. The signal is also observed during our evening to closedown at 1115UTC. The same programme is available on 3945kHz and the new channel on 4960kHz replaces 7260kHz. ◆

This item is contributed by Arthur Cushen, 212 Earn Street, Invercargill New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT) which is 11 hours behind Australian Eastern Daylight Time and 13 hours behind NZ Daylight Time.

Vintage Radio



by PETER LANKSHEAR

Vintage electronic music

Electronic equipment in various forms is an essential part of today's popular music, especially for amplification, note generation and tone modification. For half a century and more, there have been power amplifiers, electric stringed instruments, electronic organs, and more recently synthesisers have added their distinctive character. As with many branches of electronics, pioneering efforts created some interesting equipment.

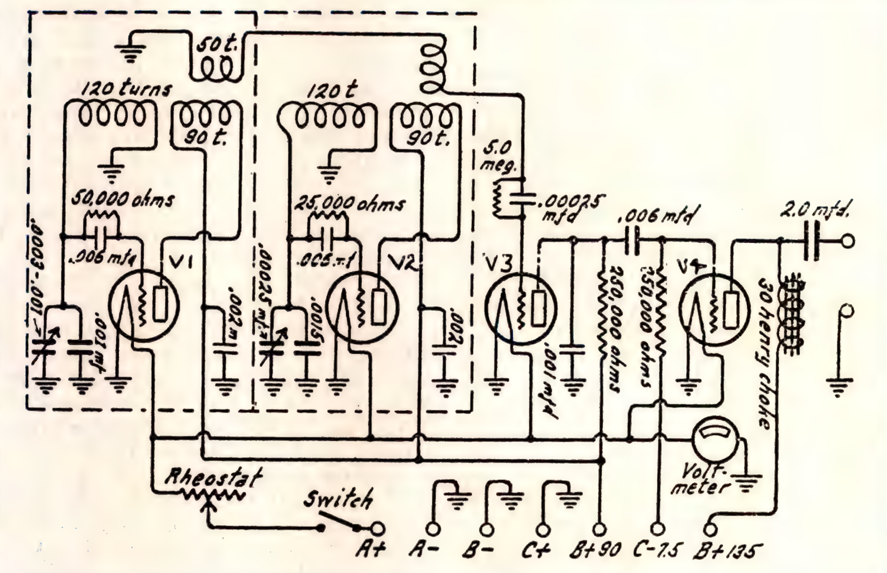


Fig.1: The Beat Frequency Oscillator, an early type of variable audio frequency generator. The signals from variable frequency RF oscillator V1 and its fixed frequency partner V2, were combined in the grid leak detector V3 and the audible difference beat, or heterodyne, was amplified by output valve V4.

The death about five years ago of Leon Theremin at the age of 97 was a reminder of the achievements of a remarkable but relatively little known pioneer. A brilliant engineer, and also a capable musician, he is best known for his invention of the electronic musical instrument that took his name.

He was born as Lev Sergeyevich Termen in the beautiful Northern Russian city of St Petersburg (called Leningrad following the revolution, but with Lenin falling from favour, it again has its original name) where he was educated in physics, astronomy and most importantly, music — especially the cello. After moving to America, when presumably he anglicised his name, he developed some electronic instruments, including the 'Rhythmicon' which generated different rhythms, and which seems to have been a forerunner of the drum rhythm facility of some electronic organs.

Leon Theremin combined his musical and electronic talents to set about developing a completely new musical instrument, that did not depend on banging, scraping, strumming, plucking or blowing! Perhaps not surprisingly, he based it on existing electronic tone generation technology. Named after himself, the instrument was demonstrated first in Carnegie Hall in 1929, where it was well received.

As can be seen from Fig.1, it somewhat resembles a conductor's podium sprouting two antennas — one a straight rod, the other bent in a loop. As is usual with electronic instruments, a loudspeaker completes the equipment.

Electrical tone generation is as old as telephony. According to some accounts, it was Alexander Graham Bell's practised ear recognising harmonics in the waveform generated by a plucked steel strip placed close to an electromagnet that led to his inventing the telephone. Of course, alternating current generators could produce sinewave voltages in the audio range, but it was not until the availability of amplification that variable electrical tone generation could become a practical reality.

Single note generation by a steel tuning fork and sustaining amplifier was an early single frequency method, but with the technology existing, a variable frequency was hard to produce. Simply to scale up the coil and capacitor combination used for RF oscillators was impractical. For example, a tuned circuit resonant at 1kHz with a 0.001mfd (1nF) tuning capacitor requires an inductance of about 25 henries, which for sufficient accuracy should be air cored.

Clearly a different approach was required, and during the 1920's the 'Beat Frequency Oscillator' or BFO appeared, a typical circuit being shown in Fig.2. The basic operation is quite simple, and is derived from heterodyne reception, first suggested about 1904.

Referring to Fig.2, there are two RF

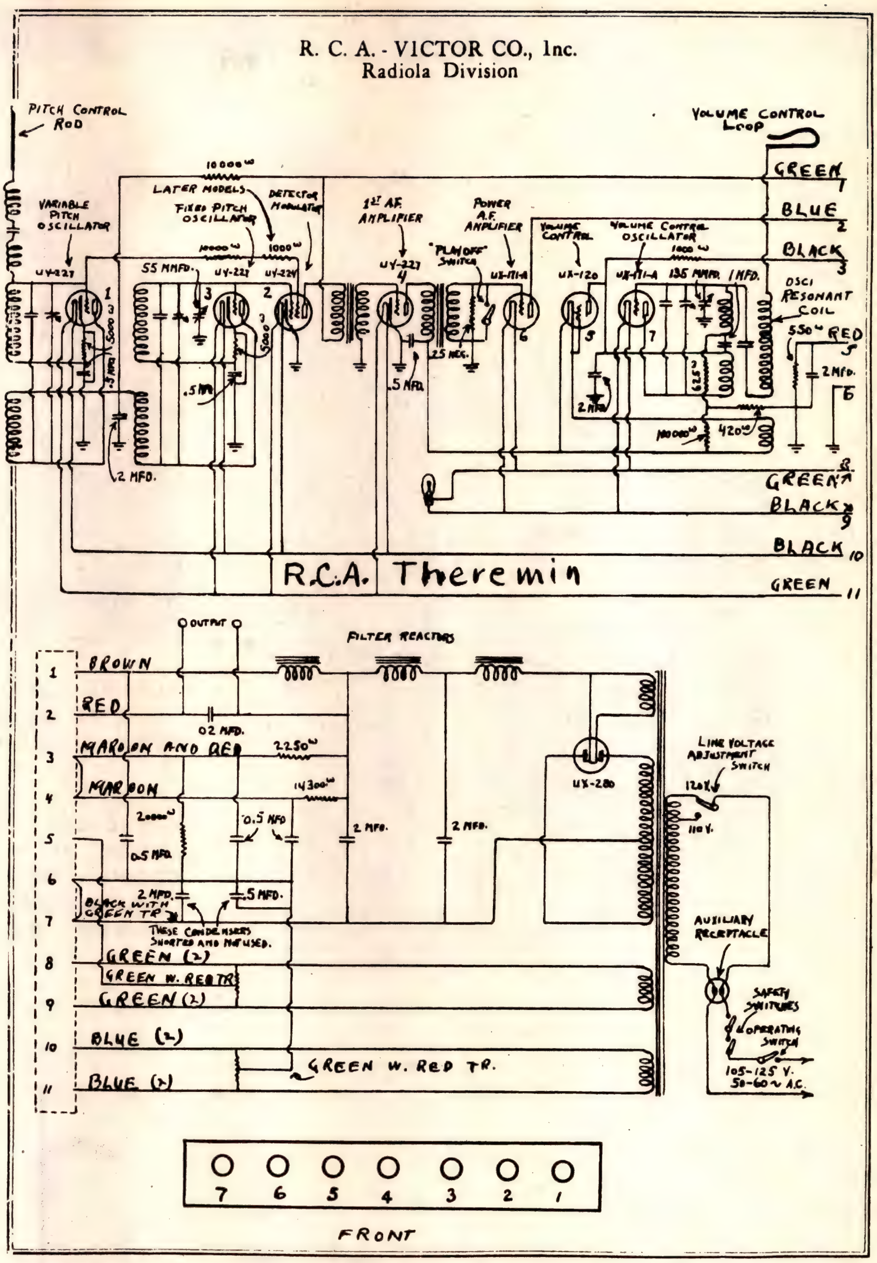


Fig.3: RCA built the Theremins after Atwater Kent declined, and as was their standard practice at the time, the power supply was constructed on a separate chassis.

oscillators. V2 operates as a fixed frequency oscillator, while V1 is variable, tuned by a 300 - 1000pF tuning capacitor. Samples from both tuned circuits are combined in a square law detector V3, and the difference frequency or 'beat' appearing at its output is amplified by the fourth valve.

With the two oscillators operating at the same frequency, there is no beat, but as the difference increases, so an audio beat with increasing frequency is generated. By suitably proportioning the tuning range of the variable oscillator, any desired part of the spectrum can be covered. Many of the early audio signal generators used this BFO principle.

Theremin understandably based the operation of his instrument on the beat frequency oscillator, but to produce music by rotating a dial was obviously impractical.

No physical contact

The Theremin is unique in that there is no physical contact with the operator. Instead it is 'played' by varying the positions of the hands in relation to the aerials. Anyone who has operated an unshielded regenerative receiver in an oscillating condition, whereby the received signal is continuously heterodyned, will know that, although the results are not very musical, it is possible to vary the tuning capacitance and with it the frequency of the audible note by putting a hand near to the detector coil. Theremin used a refined version of this for his oscillator control.

Approaching the rod antenna with the right hand raises the pitch of the rather eerie sound, which is not unlike that produced by the old party trick of a carpenter's saw played with a violin bow. Vibrato effects can be added by rapidly wriggling the fingers of the right hand, although in the recordings that I have heard, this effect is not much in evidence.

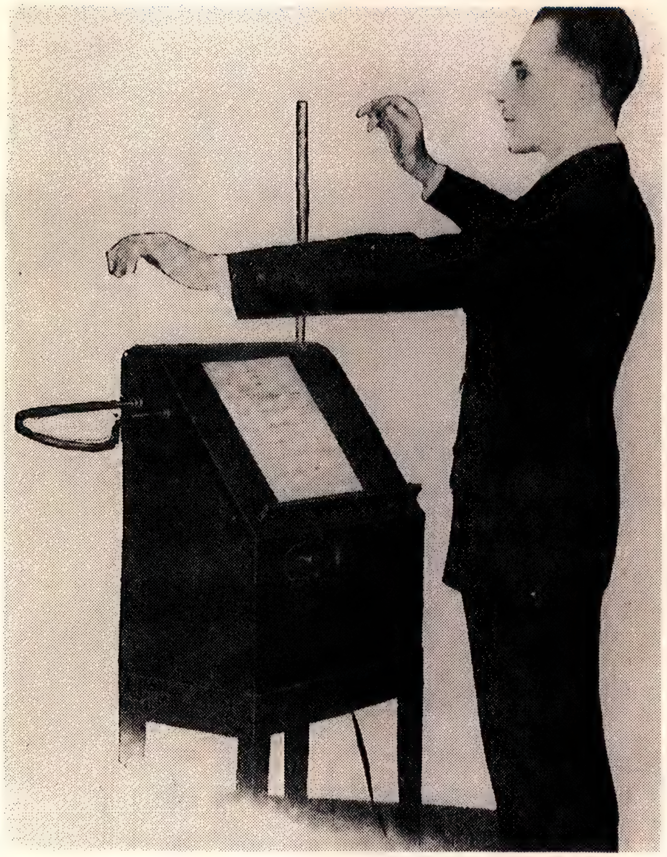
Volume is controlled by the proximity of the left hand to the looped antenna. The closer the loop is approached, the greater the volume. A later modification in some instances was the more conventional resistive volume control.

Three oscillators

The schematic of Fig.3 shows the circuit of the original Theremin, taken from Rider's *Perpetual Trouble Shooter* Volume 1, page 505. This book confirms that the RCA Theremin would have been produced in 1929/30, and provides a detailed idea of the Theremin's operation which was quite sophisticated for its time. It uses a 224 screened grid valve which was not available until early 1929, and had production of the Theremin been later than 1930, the circuit would have appeared in a later edition of Rider. The heterodyned outputs of a pair of oscillators, one controllable in pitch by the proximity of an operator's hand to an aerial rod, provides the melody. A third oscillator, controlled by the other hand, regulates the volume.

V3 is a simple fixed-frequency cathode biased 227 triode oscillator, operating in a clear channel somewhere near 500kHz with a tuned grid and an anode feedback winding. V1 is another 227 oscillator, but is coupled to the short vertical tuned aerial called the 'pitch control rod'. The grid of V3 is connected in parallel with the control grid of V2, a 224 tetrode, while the grid of V1 is connected to the outer screen grid of V2, which operates as a sort of bi-grid valve, forming the mixer or detector stage.

In the quiescent state the two oscillators operate at the same frequency and produce no audio beat. (One fortunate characteristic of beat frequency oscillators in this sort of application is that as the frequencies of oscillation



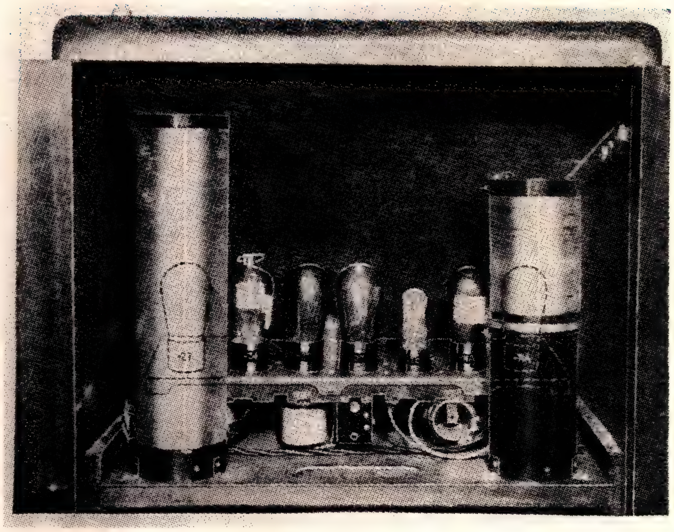


Fig.2 (left): Leon Theremin playing his instrument, which somewhat resembles a podium. The volume loop and pitch antenna can be clearly seen.

Fig.4 (above): The rear of the Theremin with the cover removed. At the left, the large coil is the pitch aerial loading coil, while the coil at the right belongs to the volume control oscillator. This photo and that of Fig.2 have been copied from 'Radio News' for March 1930.

approach each other, there is a strong tendency for them to lock, producing a zero beat). A hand in the proximity of the rod alters capacitance and with it the variable oscillator frequency. The closer the approach, the more the frequency is changed and the pitch of the beat frequency raised.

The audio frequency beat appears at the anode of V2, which is transformer coupled to a 227 triode audio amplifier stage (V4) — whose anode voltage is supplied in series with V5, a diode connected thoriated tungsten filament type 120 valve. From the anode of the first AF amplifier, the audio signal is transformer coupled to a 171A power triode (V6), which provides the drive to the external loudspeaker of the Theremin.

Fig.5: Another photo, taken from the Australian magazine 'Radio' for May 15, 1928, showing Theremin demonstrating his instrument to Sir Robert Hadfield in London. The article in which it appears is headed 'Russian Inventor Plays Tunes with Howling Valves'.

Novel volume control

The technology used in controlling volume is ingenious, and was quite sophisticated 65 years ago. Valve V7 is another 171A power triode, connected as an oscillator. A small positive voltage grid bias of about a volt is provided by a voltage divider formed by the 100kΩ and 420Ω resistors. The oscillator coil has two additional windings, one of which lights the 3.0 volt filament of the type 120 valve (V5). A fourth winding and the 'loop' aerial form a high-Q resonant aerial system. In the resonant condition, the loop and its coil absorb most of the oscillator's energy, and the filament of V5 receives minimal voltage. Consequent-ly, V5 will not permit any anode current to flow, and the first AF amplifier V4, whose anode is fed from V5, is inoperative with no signal reaching the grid of the AF power amplifier.

When the aerial system is detuned by the proximity of the of the musician's left hand, less energy is absorbed by the loop, and instead becomes available for the filament of the control valve, V5. This makes V5 conductive, permitting current to flow in the first AF amplifier and the musical tone to reach the power amplifier. The success of this novel method of volume control would have been dependent on an unusual characteristic of the thoriated tungsten filament of the 120 type valve. Thoriated tungsten filaments provide an extended relationship between filament current and emission, and would provide a smoother control than would an oxide coated filament.

To ensure that the Theremin remains completely silent when not required, there is a 'Play Off' switch to earth the control grid of the power amplifier stage.

As was common RCA practice at the time, the power supply was made a separate unit and the circuit shows safety switches to disconnect power if access covers are opened. The power supply unit appears to be remarkably similar to that used for the all triode Radiola 60 superhet, which by late 1929 was becoming obsolete.

Initially Theremin offered manufacturing rights of his instrument to Arthur Atwater Kent, but the latter considered that it was insufficiently developed and with limited potential demand, and the project was instead taken up by RCA. One suspects that ultimately, Atwater Kent's opinion was correct.

The Theremin is too restricted in performance to ever be more than a novelty instrument, although some music was written for it and it is occasionally heard in broadcasts. Plans for later versions have been published from time to time, but there was not much further development. Major limitations are that chords are not possible, and the rather bland tonal quality cannot be readily varied. In any case with no keyboard, only gliding note changes are possible.

Theremin developed other instruments, one being an electronic cello. There was also a small keyboard organ, but within a short while much more versatile electronic instruments like the Hammond organ were to follow — and of course, these were a considerable success. The Theremin's importance is that it pioneered the use of electronics in musical instruments, which has changed the whole structure of popular music.

Shortly before World War II Theremin returned to Russia, but was banished to Siberia — all too easy during Stalin's reign of terror — for his 'anti Russian writings'. However eventually he must have been considered to have improved his ways sufficiently, because he was released to work on military electronic equipment. Later he was to be 'pardoned' after receiving the Stalin Prize for his work.

He worked for a time as a KGB scientist, but was forced to leave Russia in 1967 after receiving too much publicity in the West. By then he would have been in his mid 70s, and unlikely to be a threat to the Soviet Union.

Footnote

And now something quite different. Provision for personalised car number plates can produce some clever combinations that can be often be humorous. American hams frequently use their callsigns. However, a New Zealand acquaintance of mine has a very novel set of plates that only a fellow vintage radio enthusiast would appreciate. His car is registered as UX201A. ❖

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READER INFO NO. 18

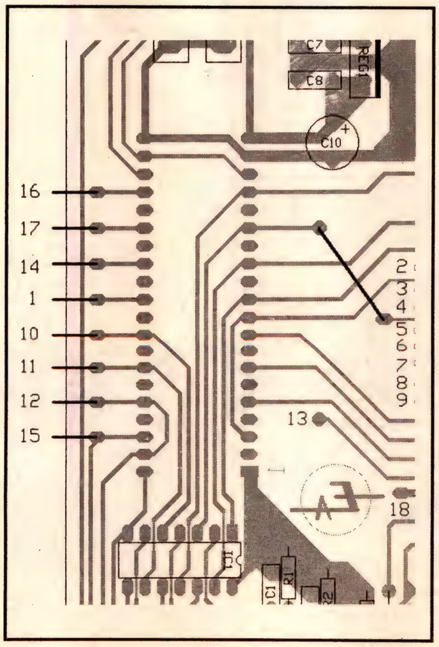
NOTES AND ERRATA

Parallel Port Break-out Box (August 1995): There was a bit of a mixup in the Parallel Port Breakout Box (August 1995). The wrong SELECT line is monitored and this will not indicate the true state of the printer. This can easily be fixed by the following procedure:

Remove lines 13 and 17 of the ribbon cable from the board. Move the wire link on the main board to the position shown on the diagram to the right.

Solder line 13 of the ribbon cable into the hole previously occupied by the link, and solder line 17 of the ribbon cable to the hole originally occupied by line 13.

Also, there is a misprint near the bottom of the circuit diagram on page 71. The ERROR line should be pin 15, not pin 13, as shown. ❖



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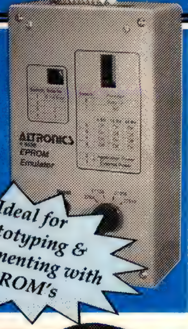
Regards, **Jack O'Donnell,** Managing Director

EPROM Emulator Kit

This EPROM emulator allows you to do away with EPROM's whilst in the prototyping stage of product development. The emulator is connected to a spare parallel port on your computer and also the 'target' board. The EPROM file (that is normally downloaded into the EPROM), is then transferred into the emulator by copying the file to the parallel port. This process saves repetitively "blowing" new EPROM's with each modification to the program. Emulates 2764, 27128, 27256 and 27512 EPROM's.

K 9530 **Just $149**



Ideal for Prototyping & Experimenting with EPROM's

I/O Adaptor Kit for PC's

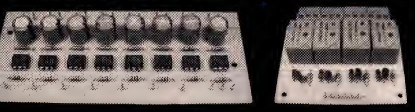
(See EA July '91)
Using this module you can computer control all kinds of things such as security systems, stage lighting, model railways, watering systems etc. The unit simply connects to a standard RS232C serial port on any PC. Features 8 digital inputs controlling 8 outputs. A simple addressing systems allows multiple units to be "daisy chained" from a single RS232C port, expanding the number of inputs and outputs up to 64.

K 2850 **$69.95**

Input Buffer & Relay Driver Kit

(See EA Feb '89) This is a companion kit for our I/O Adaptor kit (K 2850). It has four relay outputs and eight opto-isolated inputs. This kit contains all parts necessary to construct both the input and output stages and even gives basic information on 240 volt triac controlling. As there is no professional software available for these items, a Qbasic program listing is supplied to help you complete your project.

K 2852
$34.95



Combined, the K 2850 & the K 2852 Allow You to Switch On and Off Appliances with Your Computer!

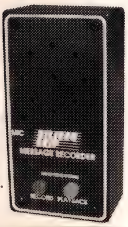
Alphanumeric LCD Module Kit

(See SC May '93) Using an alphanumeric LCD display board is not as hard as you may have thought. This kit is certainly the easiest way of learning about these devices. Simply connects straight to your printer port of your PC. N.B. requires software.

K 2825 **$39.95**
K 2827 3.5" PC Software Disk **$14.00**

Includes Aplphanumeric 16 Character by 2 Line Digital Display

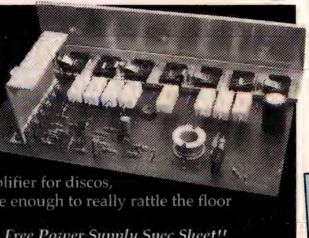
16 Second Message Recorder Kit



(See SC July '93) This is an interesting kit that makes use of new technology to record audio signals. Whilst most recorders store the audio in digital form and thus require back up power, the IC in this kit stores the signal in analog form and can retain the information for up to 10 years. Can store one message of up to 16 seconds. Simple Record and Playback pushbutton operation. Kit includes speaker, professional screen printed front panel etc.

K 9560 $69.95, **This Month Only $49**

350W Amp Module Kit

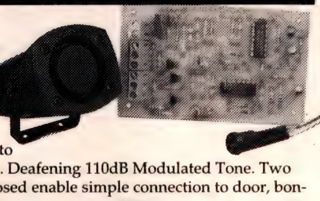


This fantastic amplifier will deliver a massive 350 watts RMS into 4 ohms. Using the latest mosfet technology and circuit design techniques this kit is supplied as a basic module, which makes it ideal to be built into subwoofer enclosures, juke boxes and mixers etc. Housed in a suitable enclosure this kit will make a simple superb mono or stereo (using 2 modules) high power amplifier for discos, public address or even in the home if you are game enough to really rattle the floor boards!

K 5180 **$189**

Call Us for a Free Power Supply Spec Sheet!!

Screecher Car Alarm Kit

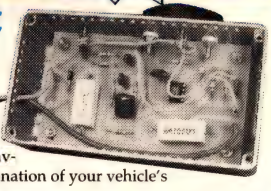


(See EA Aug '86) Here is a low cost car alarm designed with a new deterrent strategy. Instead of using the alarm to try and draw attention of passers-by to the felony in progress, this alarm sounds inside the car to deafen the thief and make it too uncomfortable to proceed. Makes an ideal second/back-up alarm. Deafening 110dB Modulated Tone. Two sensor inputs - Normally open and normally closed enable simple connection to door, bonnet, boot light, switches etc.

K 4360 Normally $49.50, **This Month Only $39**

Cheap Piece of Mind for Your Car

Electronic Ignition System Kit



(See SC May '88) This "state of the art" electronic ignition system uses the same semi-conductors as found in modern motor car ignitions. Extends the life of plugs and points. Increases power and improves fuel economy. Compatible for 4, 6 and 8 cylinder engines. Install one into your car and start saving $$$ from the very first day. Comes with full explanation of your vehicle's ignition system.

K 4015 $58.50, **This Month $49**

Induction Loop Pickup Kit

(See EA Oct '95) Here is a novel way to listen to the television, CD etc with headphones but without long wires back to the set. Handy for listening to TV in bed, or for getting 'that little bit more volume' without irritating other members of your family. This works on the same principal of induction loops for hearing aids. Simply set up by laying cable around the ceiling or floor of the room. Full details supplied. Receiver can fit in pocket or clipped onto belt. Does not include earphones.

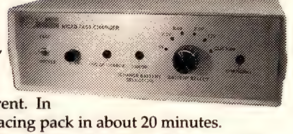
K 5200 **$24.95**

Gain Controlled Mic Preamp Kit

(See SC Aug '95)
Designed for use with PA systems this unit simply plugs in between your balanced microphone and amplifier. It will monitor the microphone input level, and adjust the volume to maintain a constant output level. This will ensure that the amplified sound level is always the same, regardless as to how loudly (or softly) a person speaks. Includes an XLR type socket for a balanced microphone input, and an unbalanced 6.35mm output socket. Requires 9V DC M 9105 power supply (not included).

K 5520 **$29.95**

Fast Nicad Battery Kit



(See SC Jan '91) Operating from a 12V DC battery, this charger can charge 6V to 12V nicad battery packs at up to 6A, or you can custom wire the unit to charge battery packs up to 30V at a reduced current. In operation the circuit will recharge a typical nicad racing pack in about 20 minutes.
Features: • Fast charge rate • Switch selectable voltage setting in 1.2V steps from 6-12V • Fully punched and screened front panel • State of the art digital circuitry

K 1660 Normally $129.00, **This Month Only $99**

40 Volt 3 Amp Variable Power Supply Kit

(See SC Jan/Feb '94) This 1.23 V to 40 V adjustable power supply is designed for heavy-duty work. It uses a high efficiency switching regulator circuit. Features preset voltage and current limiting, full overload protection (with indicators) and an LCD panel meter for precise voltage and current readouts.

K 3330 **$239.95**

Includes LCD Digital Display for Precise Measurement!

Multi-Station Headset Intercom Kit

Calling All Muso's & Theatre Production People!

(See SC June '92) This multi-station headset intercom is designed to provide clear communication in high noise environments such as at race tracks and rock concerts. It is designed to operate with a headphone and mic combination. Each headset requires a station module. Stations are simply connected in a daisy-chain fashion. Up to 12 units (stations) can operate from one power supply. Features low noise circuity and compares favourably to commercial equivalents. Mics can be switched on continuously (even at the one time) for hands free operation of all stations. Also includes visual and audio call function. Ideally suited to our C 9055 headset mic and the C 9070 noise attenuating Aviation Headset.

K 5250 Station Module **$74.95**
K 5255 Power Supply **$64.95**

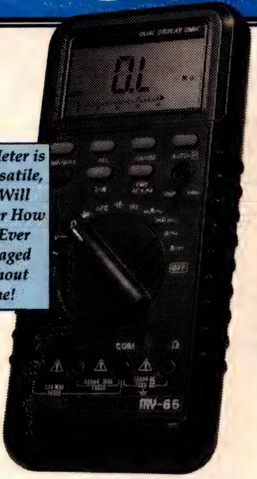
ALTRONICS Fax Order Line: (09) 328 3487

1-800 999 007 PERTH (09) 328 1599

Doc.JH340

OVERNIGHT DELIVERY

3.75 Digit Dual Display Auto Ranging Digital Multimeter



One of the Best and Most Popular Meters We've Ever Stocked!

This fantastic auto-ranging meter features minimum and maximum functions. Memorise an input for later reference. Continuity and diode check. Can measure AC voltage and frequency simultaneously. Capacitance test 4nF to 40µF. Frequency check 10Hz to 120kHz. Transistor gain check for both NPN and PNP transistors. 41 segment analogue bargraph, stopwatch function, 10 amp fuse protection and full 2 year warranty. Relative sampling displays either % or actual value difference of the current input compared to a memorised input. Auto power off. Large 16mm 3.75 digit display with bargraph.

This Meter is So Versatile, You Will Wonder How You Ever Managed Without One!

Please call us or a full specification sheet.

Q 1045 **$179**

High Power 6 Tone Sirens

Massive 120dB Output!

Continuously cycles through 6 different alarm sounds, each of 6 seconds duration. Each tone can be enabled/disabled via internal DIP switches. Certainly attracts some attention! Requires 12V DC at 1.2A. Dimensions ≈80mm Ø by ≈80mm Long (excluding the bracket).

Scoop Purchase! Normally $39.95 Save Over 50%

Hurry, Stocks are Strictly Limited at This Price

S 6134 **$19.95**

Solar & Battery Powered AM/FM Radio

Fantastic for sports fans and lovers of the great outdoors! No need to worry about batteries next time you go to the cricket or out gardening etc. Inbuilt solar cells will charge the internal nicad battery. Will automatically use a standard (non-rechargeable) AA battery should the nicad run out (ie. night time use). Supplied complete with earphones!

A 2250 Normally $39.95, **This Month Only $29**

Solar, Dynamo & Battery Powered AM/FM Radio

Features: Built in solar panel and dynamo generator, can be fitted with 2 "AA" batteries (for backup at night) and provision for DC external plugpack. Built in nicad backup battery is charged by the radio's own solar panel.

A 2255 Normally $49.95, **This Month Only $39**

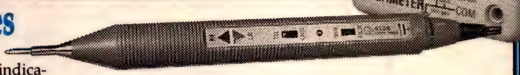
19 Range Digital Multimeter

Amazing Meter for Under $30!

After evaluating 30 or more meters of this calibre we found the Q 1053 to be the best value for money by far!

This 3.5 digit multimeter features a 19 position, easy to use rotary switch for function and range position. Includes AC/DC voltage check, 10A DC current, resistance, diode and a transistor test function. This meter offers many of the features of much more expensive models but at the fraction of the cost. Ideal for the cash strapped student, or budding enthusiast!

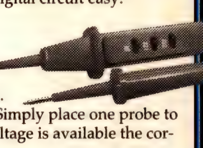
Logic Probes



Features audio and visual 'hi' and 'low' indication. Detects pulsing signals down to 30ns pulse duration. TTL and CMOS compatibility at the flick of a switch. Makes observation and fault finding of any digital circuit easy!

Q 1272 20MHz Logic Probe **$39.95**

AC/DC Low Voltage Test Probe



Ideally suited for tracing or locating voltages up to 24V AC or DC. Excellent for working on cars, boats or trucks electrical systems. Simply place one probe to earth and place the other probe onto the wire to be checked. If voltage is available the corresponding (6, 12 or 24V) LED will light. Very simple to use.

Q 1230 **$7.25**

High-Tech Remote Car Alarm

This amazing model features just about everything you could imagine! Multi-function keyring remote control will arm and disarm alarm (and activate central locking if fitted), chirp the horn, turn on the car headlights, panic and even open the boot (if actuator fitted). One remote can control two alarms (in two cars). Other features include starter inhibit, valet mode, central locking interface, flashes car indicators when tripped, auto reset, user programmable options plus much more.

Save a MASSIVE $100

S 5230 Normally $249.00

This Month Only **$149.95**

Hurry - Only 14 Left!

Altronics Retail Store Perth
Now Open Extended Hours
Saturday - 8:30am to 5:00pm
Sunday - 12:00pm to 5:00pm

Professional 4 Sector Digital Alarm System with Auto Dialler

Amazing Value! As used by Many Commercial Alarm Installers Australia Wide.

This alarm panel is the same type as used by many commercial alarm companies to protect both residential and commercial properties.

Incorporating an inbuilt Austel approved auto-dialler, this great alarm can be configured to automatically dial two preset numbers in the event of an alarm, i.e. could be configured to automatically ring a neighbour or an alarm monitoring company. The main controller circuitry is housed in a sturdy steel cabinet. Provision is made to house an optional back up battery if required. The keypad control unit is generally located at the front door for easy access to arming and disarming of the system. The entire system is controlled and programmed via this keypad. Virtually any type of sensor can be used with this system. A combination of normally open and normally closed sensors can be used on any zone. Each zone is monitored by end of line resistors to maintain system integrity, i.e. if someone interferes with the system wiring the alarm will sound immediately.

Features: • master code and three adjustable user codes • monitor function which tests features like battery backup and mains failure • four individually programmable sectors with a large array of functions available • all four sectors utilise extensive noise protection circuitry and end of line resistors for added security • once triggered the alarm has the option of a silent alarm, and dialling a friend or monitoring company • quick arming option • zone bypassing for sectors which are false triggering • bell test - to test the external sirens without dialling out • door chime mode for entry/exit paths • battery backup • home or away operation • accessible alarm memory for confirming which sectors were triggered • separate instruction and installation manuals • 12 months warranty

S 5490 **$299**

M 9140 16V AC Plug Pack with Earth to Suit $32
S 5492 Extra Keypads to Suit $135 ea
S 5065 12V 1.2AH Backup Battery to Suit $32.50

PIR Movement Detector

5 Year Warranty

Small and sleek this detector is ideal for the home or the office. Range up to 13 x 13m. **Features:** • LED On/Off Jumper • Vertical Adjustment • Wall/Corner Mounting • Small Size - 62w x 88h x 48d mm • 5 Year Warranty

S 5307 **$49**

Ideal for the S 5490 Alarm Opposite

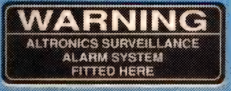
Amazing Bonus Package

Over $100 Value of Installation Accessories Including Cable, Strobe & Siren Free with Each Alarm System Purchase!

50 Metres of High Quality 4Core Security Cable (Sufficient for average 4 bedroom house).
W 0356

High Intensity Strobe
S 5455

Siren Horn
S 6130



2 Large Alarm Stickers - S 5400
Plus 4 Window Stickers - S 5410

ALTRONICS

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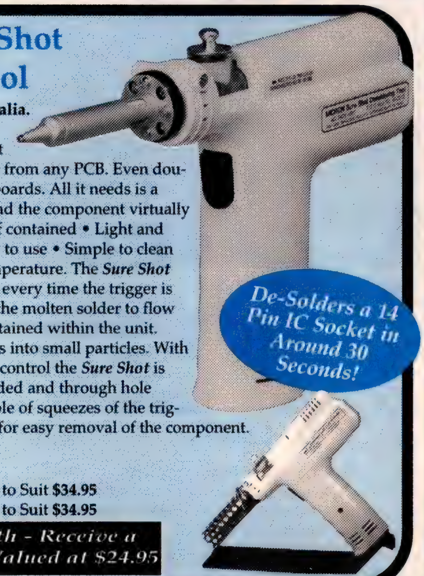
ALTRONICS COMPONENTS

ALTRONICS Fax Order Line: (09) 328 3487

Micron Sure Shot Desoldering Tool



Exclusive to Altronics in Australia. This stand alone, fully self-contained desoldering tool makes it a breeze to remove components from any PCB. Even double sided, through hole plated boards. All it needs is a squeeze or two on the trigger and the component virtually falls out. Features: • Totally self contained • Light and compact • Anti static tip • Easy to use • Simple to clean and maintain • Variable tip temperature. The *Sure Shot* generates a high speed vacuum every time the trigger is squeezed. This vacuum causes the molten solder to flow into the collection reservoir contained within the unit. Here the molten solder solidifies into small particles. With its inbuilt variable temperature control the *Sure Shot* is ideal for single sided, double sided and through hole plated P.C.B.'s. With just a couple of squeezes of the trigger all holes are left solder-free for easy removal of the component.

De-Solders a 14 Pin IC Socket in Around 30 Seconds!

T 1280 $349

T 1282 1.0mm Replacement Tip to Suit **$34.95**
T 1283 1.6mm Replacement Tip to Suit **$34.95**

Bonus This Month - Receive a Free Bench Stand Valued at $24.95

Super Heavy Duty Pliers & Cutters

This Month Only Buy Both for $20 - Limited to First 100 Callers Only

Special high quality steel for excellent cutting capacity and durability. Handles are coated in long lasting and comfortable grips. Ideal for cutting heavier gauge electrical wire.

T 2800 Pliers Length ≈210mm. **$9.50**

T 2830 Side Cutters Length ≈160mm. **$15.95**

Micron Series II Soldering Station

Amazing Special! A Professional Soldering Station for Under $100. Why Pay $160 or More?

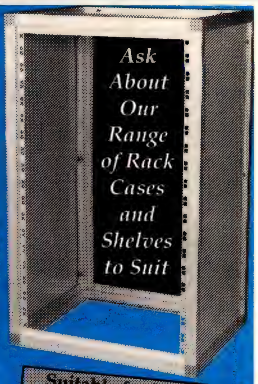
The *MICRON* Series 2 soldering station employs electronic switch mode circuitry in lieu of a mains transformer. Excellent for all general purpose and production soldering. **Features:** • High insulation ceramic heating element • Rapid heat-up and instant recovery • Heater insulation of over 100MΩ • A zero voltage circuit ensures no high voltage spikes or magnetic field are present at the tip to damage sensitive components • Continuous temperature adjustable from 250° to 430°C (480° to 800°F) • Grounded power cord • Selecting the desired operating temperature is as simple as turning a knob.

Now Supplied with Long-Lasting Iron Clad Tip!

This Month Only $99

T 2443 Normally $129.95

Professional Rack Frame and Panel Set Sell Out



Ask About Our Range of Rack Cases and Shelves to Suit

These quality frames are manufactured from a heavy duty and professional looking natural anodised aluminium. The side and top panels are available separately with industrial grade Horizon Blue powder coat. Ideal for use in home Hi-Fi systems, professional audio installations, Band Gigs, Computer patch panels etc. Supplied in flat pack form. Easily assembled in minutes with minimal tools and effort.

AUSTRALIAN MADE

		Were	This Month
H 5204	Rack frame 4U	$139.00	$97
H 5205	Panel set for H 5204	$59.00	$41
H 5212	Rack frame 12U	$169.00	$118
H 5213	Panel set for H 5212	$99.00	$69
H 5218	Rack frame 18U	$189.00	$132
H 5219	Panel set for H 5218	$119.00	$83
H 5230	Rack frame 30U	$229.00	$160
H 5231	Panel set for H 5230	$169.00	$118
H 5238	Rack frame 38U	$269.00	$188
H 5239	Panel set for H 5238	$199.00	$139

Suitable for home or commercial use, these fantastic rack frames are durable, strong, good looking, light weight and easy to assemble.

Save 30% Hurry - Stocks Strictly Limited!

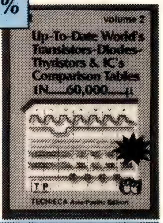
Up-to-date Worlds Transistors Diodes Thyristor IC's Comparison Tables I

Volume one lists comparison tables of nearly 28,000 types of components. It lists over 80,000 comparisons and equivalents. Lists semiconductors with prefixes A - Z. 1095 pages.

B 1265 $19.95

Buy Both Volumes for **$29** *and Save 25%*

Up-to-date Worlds Transistors Diodes Thyristor IC's Comparison Tables II



B 1270 $19.95

This extremely compact book of equivalents gives brief description and specification as well as full pin assignments of 28,000 types of transistors, diodes, thyristor and IC's. An excellent reference book for professionals and hobbyists alike. 954 pages.

Altronic Dealers Wanted

If you have a dynamic electronics business and would like to sell Altronic Products and Components - We would like to hear from you! Contact Greg Liddelow at Altronic Distributors Wholesale on (09) 328 2199.

ALTRONICS

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Phone (09) 328 1599, **Fax** (09) 328 3487
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We welcome ... bankcard MasterCard VISA

Standard Delivery & Packing Charge: $4.00 to 500gms, $5.50 500gms-1 kg, $8.00 1kg-5kg. Where possible we process your order the day received and despatch via Australia Post. Allow approx 9 days from day you post order to when you receive goods.

Overnight Jetservice: Up to 3kg is $10.00, 3kg to 5kg is $18.00—We will process your order the day received (if placed before 2.00PM WST) and despatched for delivery the next day. Country areas please allow an additional 24-48 hours.

Heavy Service: All orders of 10kgs or more must travel Express Road—Please allow up to 7 days for delivery. $12.00 to 10kgs. $15.00 over 10kgs. **Insurance:** As with virtually every other Australian supplier, we send goods at consignee's risk. Should you require insurance cover against loss or damage please add $1.00 per $100 of order value (minimum charge $1). When phone ordering please request "Insurance". **Altronics Resellers:** Chances are there is an Altronics Reseller right near you—check this list or phone us for details of the nearest dealer. Blue Ribbon Dealers are highlighted with a ●. These dealers generally carry a comprehensive range of Altronic products and kits or will order any required item for you.

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	David Reid Elect. ●	(02) 2671385
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NEWCASTLE	Novocastrian Elect.Supplies	(049) 621358
WARNERS BAY	Vilec Distributors	(049) 566792
WOLLONGONG	Newtek Electronics ●	(042) 271620
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Dec.JH340

50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Below we feature some items from past issues.

October 1945

Pocket Xmitters: Pocket sized radio telephones are expected to be marketed in the US in six months. The phones will cost £7/10/- and will be effective for distances up to three miles. The Federal Communications Commission has approved the instruments, providing the purchasers sign papers guaranteeing they are for their personal use.

Colour television: Commercial broadcasting of colour television is expected to be introduced in New York before the end of the year, according to plans of the Columbia Broadcasting System. There will also be black and white pictures which are claimed to show twice as much detail as prewar television pictures.

Dr Peter Goldmark, CBS, Director of Engineering Research and Developments, announced that a new television transmitter would be installed in the spire of the Chrysler Building.

October 1970

Computer link to NZ: A data transmission link has been established between Australia and New Zealand to permit data to be fed into a remote terminal unit at Dunedin for processing in a computer in Sydney. The remote terminal was installed in Dunedin to provide a demonstration of a computer hire service to delegates attending a three day computer conference.

Jobs for old satellites: NASA is offering interested scientists the use of the scientific instruments in six satellites which have been in orbit as long as six years. These have long exceeded their predicted lifetimes in orbit, and have satisfied their original objectives, but are still capable of operation.

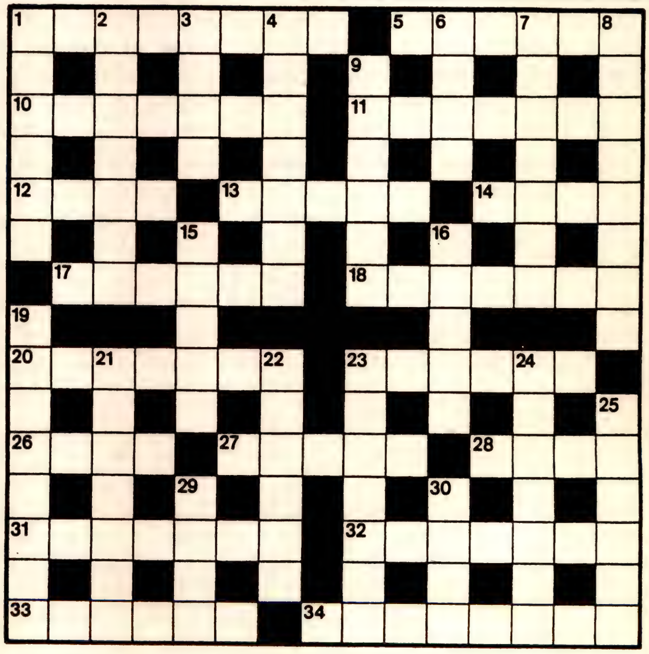
NASA is seeking proposals to conduct new scientific investigations with either data already gathered by the satellites or by proposing new experiments for the instruments still orbiting the earth.

Electronic telex exchange: The Overseas Telecommunications Commission (Australia) has placed a $2 million order with the Swiss firm of Haler A.G. for an advanced computer controller international telex exchange for installation in Sydney.

It is expected to go into operation in early 1973. With a capacity in excess of 1000 telex circuits and capable of extension, the new exchange will supplement the existing facilities which are currently being extended to a total capacity of 840 circuits.

The new exchange will be fully automatic, to conform to the Commission's program for the rapid further development of international subscriber-to-subscriber telex dialling. ❖

EA CROSSWORD



ACROSS

1. Mass of information. (8)
5. Retailer, Rod —— Electronics. (6)
10. Pioneer in electro-physiology. (7)
11. Name of series of inter-planetary probes. (7)
12. Check circuit, etc. (4)
13. Section of amplifier. (5)
14. Pipe for cables. (4)
17. Fusible alloy. (6)
18. Frequency seeking device. (7)
20. Electronics company of European origin. (7)
23. Group of stars within Great Bear. (6)
26. Abbreviated term for tertiary college. (4)
27. Overloaded and improperly maintained circuitry may cause ——. (1,4)
28. IBM computer operatng system. (4)
31. International electronics firm. (7)
32. Providing navigational pathway. (7)
33. Transmitted wave. (6)
34. Capability unit with symbol MB. (8)

DOWN

1. Units of numerical display. (6)
2. The 13th natural satellite of Saturn, discovered in 1980. (7)
3. Voltage applied for optimisation. (4)
4. Common name for a spanner. (7)
6. Said of noble gasses. (4)
7. Damage to CRT phosphor. (3,4)
8. Phase reversers. (8)
9. Pictures on a screen. (6)
15. Circuit that performs a mathematical function. (5)
16. Conductor's wand. (5)
19. Similar atoms with different mass numbers. (8)
21. Making impressions. (7)
22. Least dangerous. (6)
23. Nearest part of orbit. (7)
24. Force field. (7)
25. Further part of orbit. (6)
29. Prefix indicating ninth power of ten. (4)
30. Phonetic word for twelfth letter. (4)

SOLUTION FOR SEPTEMBER 1995

F	I	R	S	T	O	U	T		R	H	Y	T	H	M
L		O		I		P		I		E		U		A
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INFORMATION CENTRE

by PETER PHILLIPS

A sausage powered clock, braid breakers and motorbike CDI

This month we start with a short story about a sausage-based electric cell! There's also more discussion on mosquito repellers, we look at SWR in a LAN system and readers present ideas for the mystery part of a motorbike's CDI system.

Cooking utensils have featured in this column over the years as a means of making PCBs, charging batteries, desoldering PCBs and so on, and this month I'm introducing the column with a story that combines *food* and electronics. It started when my daughter asked if I could help her science class discover the mysteries of electricity by way of a lemon-based electric cell.

After plucking a couple of likely looking lemons from the backyard tree, I poked two electrodes — one a piece of copper wire, the other a galvanised nail — into one of the lemons and measured the output voltage between the electrodes. The open circuit voltage was nearly 1V, and the cell could deliver up to 100uA of current.

However, a meter is not much of a way to show the output of a cell to a group of school children. Instead, I needed something more dramatic and obvious. The answer was a cheap LCD clock, costing around $4 at a local discount store. I found two lemons were needed, connected in series to produce enough voltage to drive the clock, which they did very nicely.

Before despatching the entire thing to school with my daughter, I showed it to a neighbour during a barbecue lunch. Encouraged by his enthusiasm, I tried a few experiments during the lunch and found a lemon could be replaced by quite a number of things — like a cooked sausage, a human mouth, a piece of soap and so on.

As we know, all that's needed is an electrolyte, either acid or alkali. The clock simply requires a voltage, at virtually no current.

The demonstration was most successful with my daughter's science class, and we all forgot about the lemon-powered clock until some weeks later when my neighbour sheepishly asked if I could help him rig up a similar setup. It turned out he wanted to take it to work to present at a party, as he had told all his work colleagues that he could demonstrate how to power a clock from a sausage.

The disbelief was so strong that he decided to take bets, promising that all would be revealed at the party.

At the time of writing, the party has not taken place, but it's clear a lot of fun will be had by all as my neighbour theatrically demonstrates that poking electrodes into a sausage will power the clock. I tried using lemon-based cells to power a sound module from a greeting card (one that laughs freakishly every time it's opened), but unfortunately the current drain is beyond a simple lemon/sausage battery.

I'm sharing this with you, as I'm sure many readers will find the idea appealing as a way of demonstrating the concept of a battery, and having a bit of fun into the bargain. After all, it's easy to forget that some aspects of electricity are very basic, and the simple battery is surely one of those.

And now, staying briefly with education, here's our first letter...

Satellite dish installers course

I receive a number of publications each month, including the bi-monthly news letter from the Electronic Services Industry Association (ESIA). Given that pay TV is now a reality, and that one of the delivery technologies for this is via satellite, I was most interested to read that ESIA and TAFE NSW have developed a course for installers of satellite dishes and associated hardware.

I contacted ESIA for more information, and the following gives the currently available details for what should prove a popular course:

Negotiations between ESIA and TAFE are nearing completion for the introduction of a Satellite Reception Installers Course. The course is expected to commence mid October and will consist of two modules (72 hours). Applicants must have either two years industry experience or have completed the Domestic Antenna Installers Course. A `challenge test' might also be provided if applicants don't meet either of these requirements.

Courses will be run at TAFE locations where a sufficient number of applications are received. Details regarding content of the course. locations, costs

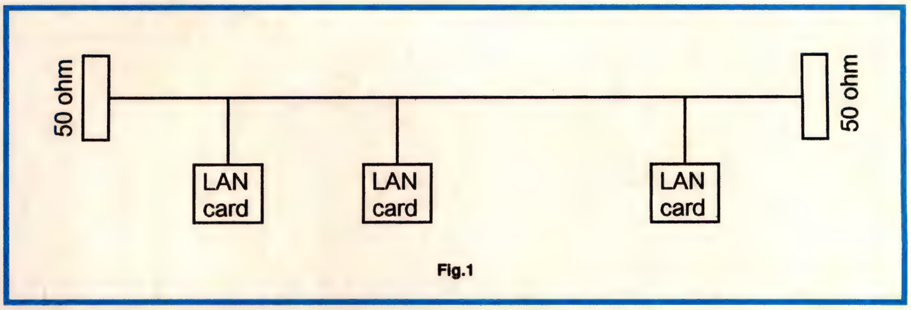

Fig.1

and so on can be obtained from ESIA by phoning (02) 876 5688. However, if you are interested in doing this course, you can register your interest by phoning the Sydney Institute of Technology Business Centre on (02) 217 4170.

Mosquito repeller

In July, I discussed the merits or otherwise of ultrasonic devices that claim to repel mosquitoes and other nasties. I included a further letter on this subject in September, and here's another from a reader who has also done some experiments in this area:

Concerning ultrasonic mosquito repellers and their effectiveness, I accidentally discovered this for myself as a 16 year old after trying out a piece of war surplus anti-submarine sonar detection equipment. It was beautifully constructed, powered from 240V 50Hz and had a high capacity 400V DC supply driving a valve powered LC tuned oscillator. The coil was a large, air cored toroid.

Naturally the first thing I did was to hook it up to 240V and switch it on to see what it did. Not a lot happened, but I left it running for a while as the valve filaments looked great in the dark. What I did notice shortly afterwards was that dozens of mossies which had previously pestered me were now solidly attached to the ceiling. Grasping the opportunity to swat the little cusses, I wondered why they didn't buzz off. In fact I could actually pick them off the ceiling.

Suspecting that the unit, still glowing comfortably a few feet away had something to do with it, I switched it off and within 30 seconds the surviving mossies took off and resumed their usual attacks on me.

Visions of fame and a quick quid disappeared when I figured the probable effect was some part of the chassis vibrating in sympathy with the (approx) 75kHz signal from the unloaded power oscillator. So mossie repellers CAN be made to work, but of course the variables involved are much more complex than a simple 'sweeper' can resolve.

I have since carried out spectrum analyses of live mossie emissions in an effort to quantify these variables. I can tell you that their sensitivity depends on many factors such as mossie species and maturity, atmospheric conditions (temperature, pressure and humidity).

It's unlikely a marketable, professional product can be made which can inexpensively cover all these variables, for all targeted species, without also attracting some of the little sods as well. The simple models, swept or unswept (and I've designed a few over the years) depend on having the right type of mossies, and then under favourable conditions to have any discernible effect. (John Byers, Midland, WA)

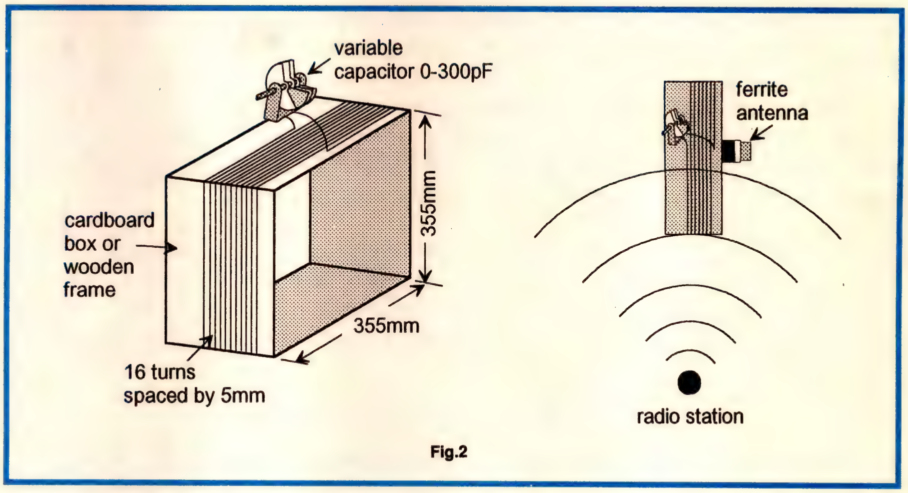

Fig.2

Thanks for this information John, you've confirmed what I've thought for years. That is, there's some truth in the belief that ultrasonic sound can repel mosquitoes, but that it's more complex than simply hooking up an ultrasonic oscillator and transducer to a 9V battery and expecting a good night's sleep.

John also raises another point in his letter which is worth mentioning, and concerns the reason for connecting small capacitors across diodes in a bridge rectifier.

Diode noise

In July, in a discussion on the reasons for CFL failure when powered from a square wave inverter, I threw in my tuppence worth explaining that it was common practice to connect low value capacitors across each solid state diode in the main rectifier of a valve TV set. I claimed that without these capacitors, the diodes would invariably fail. But now I'm not sure if I was right...

Having been brought up on communications as well as general electronics, I have seen this 'mod' in quite a few power supplies designed for communications gear.

I have also had to add such capacitors as you describe many times in the field through necessity; not to stop the diodes from breaking down as you claim, but to prevent excess wideband harmonic noise being radiated into (VHF/UHF) receivers from the rectifiers, thus reducing their S/N ratio.

Silicon rectifiers are worse in higher current applications as they have a 'break point' on their VI curve of around one volt, where they cease conducting, rather than around 0.6 volt at normal temperatures. The effect of open circuiting even a couple of amps at half a volt under these conditions causes inductive back EMF in wiring and components, which radiates broad spectrum RF energy.

It can be removed by connecting a good quality capacitor of between .001uF to 0.1uF across each diode. 'Diode commutation noise' was the term often used by the technical press, and this is also a serious but rarely publicised problem with SMPS units due to the high switching frequencies involved.

This is the only reason I have ever seen or heard for using capacitors in this manner. High speed diodes, apart from not being available at these power ratings (or at all in those days) would not have improved the effect, but merely made it worse, as the diode internal capacitances and stored charges are less than conventional diodes, providing less self-capacitive attenuation and increasing harmonic amplitude.

After reading John's letter, I began to recall that in fact the problem was not diode failure, but a loss of vertical sync, caused by diode switching noise peaking at 100Hz intervals. As the vertical frequency is 50Hz, the 100Hz bursts of RF could quite easily confuse the vertical sync separator.

So it seems my memory of the effects is wrong. Thanks, John, for putting me straight (and any readers I've misled).

LANs and SWR

Here's a question that other readers might have wondered about, dealing with the effect of SWR on a LAN system.

I have a few questions regarding impedance matching and SWR with *relation to the operation of LANs. Assume a LAN, say thin Ethernet using 50-ohm coax with 50-ohm terminations, one at each end of the cable. Each workstation is connected to the LAN by a T-piece, right at the LAN card as in Fig.1.*

When a workstation is receiving, I assume that the receiver in the LAN card represents a high impedance. This would not cause any major problems. What happens though when a LAN card transmits? What is the characteristic impedance of the LAN card transmitter? Does it really matter?

My first reaction is to assume it is 50 ohms. But surely this must upset the characteristic impedance of the whole LAN? What effect does this have on the signal as it enters the cable and splits in two (remember the T-pieces are just like a `tap' into the coax), and as it travels down the coax?

I would expect some sort of reflections and resulting corruption of the data packets, but LANs do work! Maybe I am overlooking something simple or obvious. (Peter Allison, Rossmoyne, WA)

According to my sources, the output impedance of a LAN card is relatively low, and its input impedance is quite high. As shown in Fig.1, the cable has two 50-ohm terminating resistors, one each end, usually inside the BNC connectors. This is done to keep the SWR as close to unity as possible.

A terminating resistor is not fitted at each T-piece, and the high impedance of the LAN card prevents each workstation loading the cable.

However in a simple system, the maximum cable length is 200 metres with no more than 30 workstations. Up to two repeaters are allowed, to give a maximum of 90 stations and 600 metres cable length. Any more repeaters bring about timing problems.

If either terminating resistor is removed, the system will not work as the SWR becomes too high. This can be checked quite simply by removing either resistor. The system will usually crash.

Energy monitor

In May I included a letter from a reader commenting on an Energy Auditor described in our Circuit and Design Ideas section in January. The comment was the expense of a suitable diode to pass heavy current, compared to the 1A diodes used in the design. But it may not be a problem after all...

For a number of years I have been making salt chlorinators for swimming pools, and our early versions used a diode in the supply line to detect that the filter pump was running (well, drawing current anyway), before supplying voltage to the cell.

I used a 10A 400V bridge, with the positive and negative terminals shorted together. This gives a voltage drop of about 1.2V rather than 1.8V (as specified in the energy monitor), but if 1.2V is sufficient, this method is cheap and convenient, as no mounting parts for the diodes are needed. Just screw the bridge onto a metal case or surface, with heatsink compound to increase heat dissipation and that's it. I used the 1.2V from the bridge to drive an optocoupler. (Rex Shaw, Barmera, SA)

Thanks for this idea, Rex. In fact, as I recall a 25A diode bridge is not all that expensive either, and could also do the job of passing the load current and giving a voltage drop to indicate that the appliance is on.

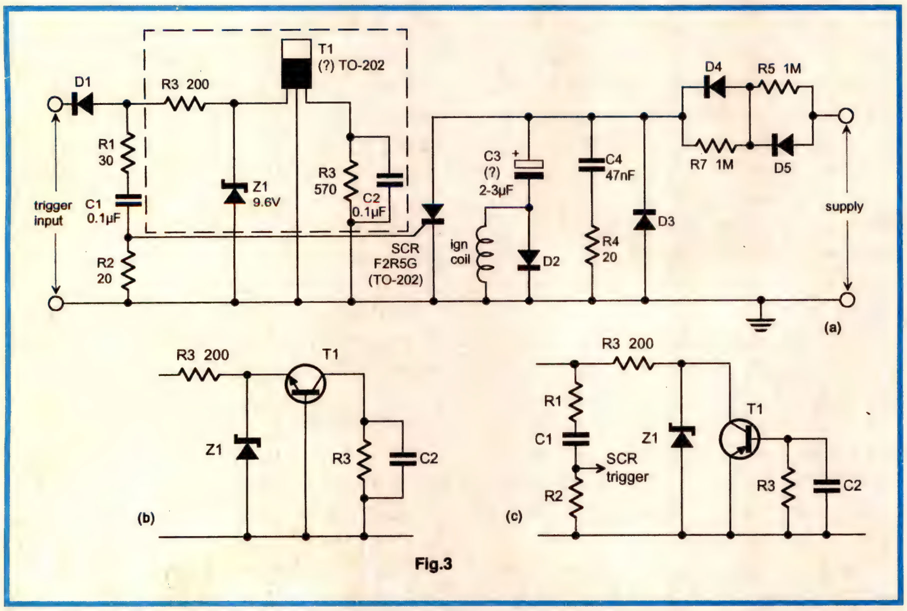

Fig.3

AM radio reception

Receiving distant AM radio stations is never easy, as we've discussed before in this column. But there's one idea we didn't raise, introduced by the next letter...

Please help. I work in the electronics/electrical retail industry, and we are getting an ever-increasing number of enquiries for AM radios that can pull in broadcasts from up to 300km away. Most customers however are very hesitant to part with $200 or more for a portable mantle radio.

I can remember a friend back in the early 80s who made, from a kit, some sort of signal enhancer or concentrator. It consisted of windings wound around a former, large enough to place the radio inside. I believe there was no connection made between the radio and these windings. Can you give me more details. (James Campbell, Kerang, Vic)

I described the very thing you are after in Experimenting With Electronics in the March '95 edition, on page 74. This arrangement, shown in Fig.2, uses a cardboard box as the former. The windings around the box (about 16 turns) form a coil that is tuned by a tuning capacitor connected in parallel with the coil.

Just put the radio (tuned to the required station) inside the box, and peak the reception with the tuning capacitor across the coil. The results can be quite amazing, and stations that were previously lost in noise suddenly become clear.

Dry cell charger

Last month I included a letter from a reader who had experienced a problem with the dry cell battery charger presented in January. It turns out he was using a DC plugpack, supplied in the kit by mistake. As the circuit relies on an AC supply, then it's no wonder the circuit didn't work as intended. So if you are having problems, check the plugpack first!

Wind direction

While I've got some vague memories of a system that can help our next reader, I'm hoping other readers can also help:

I have a simple electrical problem, but am unable to find a solution. Perhaps you or one of your readers can help me. I want to use a conventional (extended) weather vane to drive an analog, wall mounted weather vane at a remote location. That is, a pointer on a compass face. (I don't want a digital solution.)

The problems are getting a simple drive mechanism that can rotate freely in both directions, that uses readily available parts and that can work reliably 24 hours a day. (G. Kinnear, The Junction, NSW)

The concept of one rotating device being echoed by another has many solutions. When I worked in industry, there were two systems that as I recall would do the job you want. The first involved two devices called Selsyns (I think that's the right spelling), which were essentially specially wound motors interconnected with a suitable supply and with each other, so turning one caused the other to rotate exactly as the first.

These were also called synchros, and use a three-phase supply. As far as I remember, this system could operate over a full 360°. You might be able to find such a system at a disposals store. Another system used motors called Magslips, but I'm very hazy on the details.

Anyway, if anyone can give further information, let me know and I'll include details in the column.

Bike CDI system

In July I included a circuit diagram of the CDI unit from a Kawasaki motorcross bike. The unit was buried in epoxy resin, and our correspondent (Mark Lovell) had quite a job to trace the circuit. Unfortunately, after all this work, two unknowns remained: identifying one of the components, and the purpose of the part of the circuit containing the unknown component. I've since received two letters about this unit. Here's the first...

As the What?? question in July was a little easy, I turned to the CDI problems of the KX-125. The unknown T1 is an NPN transistor and is used to shape the pulses. T1 is wired like a common-base amplifier, with the input fed to the emitter via R3 and the collector taken to a (relative) positive voltage by the 570 ohm resistor.

A negative pulse from the pickup will cause the transistor to conduct, resulting in C1 charging. This generates a very short, positive-going pulse at the gate of the SCR, causing it to fire.

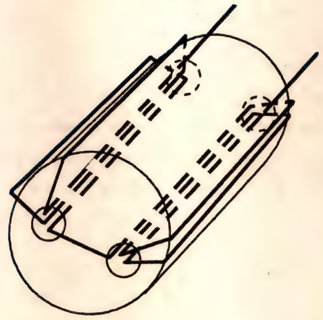

Fig.4

I actually built the circuit on the bench, and when T1 was removed, the pulses died. Therefore, I think that if Mark replaces T1 with any decent NPN transistor, the CDI will run again. I certainly hope so, as the cost of replacements are ridiculously high. (Leon Miguel, Hope Valley, WA)

Before I comment, here's the next letter, which has another solution:

I recently had the same problem with my son's Yamaha Pee Wee 80. Luckily the CDI unit proved not to be the faulty part, but the cost of a new one at $175 made me stop and think about motorcycle CDIs. The PW80 maintenance manual shows that their CDI would be similar to the Kawasaki. The CDI provides ignition timing advance and I feel sure that this is the function of the mystery circuit in the Kawasaki CDI. I have attached a circuit which might work in this way, assuming the three-pin device is a PNP transistor.

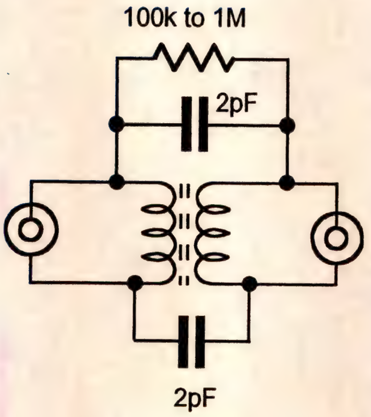

Fig.5

As engine speed builds up, capacitor C2 gets more frequent pulses from the magneto and charges up to a higher voltage, turning on T1. The increased current through T1 bypasses some of the charging current of C1. This would increase the time for the voltage on R2 to reach the SCR trigger level and so `advance' the timing. This explanation is only speculation as I have not had time to try it, and the component values don't seem to suit.

An article on motorcycle CDIs would be very welcome, as the cost of these units seems to be extortionate considering the cost of the component parts. It is crazy that some of these bikes get written off because the cost of a replacement CDI unit is about half the total value of the bike! (Michael Anderson, Strathfield, NSW)

As you can see, both letters have a different solution to the problem. Motorbike CDIs are certainly not my forte, so I can't comment other than to include the original circuit from Mark Lovell (Fig.3a), Leon's circuit (Fig.3b) and Michael's circuit (Fig.3c). Incidentally, I'll be happy to include any more thoughts on this circuit.

A common theme in this is the excessive cost of these systems. This seems to be very common across the board, and I remember being approached some time ago by a water-ski owner urging me to design a CDI system for water-skis. "You'll make a fortune, as they're always breaking down and cost the earth to replace."

It seems manufacturers rely on the fact that because it's in an epoxy block, people will think a CDI (or similar) unit contains some very expensive parts, and therefore happily pay up. Unfortunately we know better, and can see that the whole thing is a rip-off!

Braid breaker

This subject seems to come up nearly every month. This time I need to make a correction to the diagram I presented in August.

The reader (Roger Green) who sent me the design of a braid breaker has since advised me that I've misinterpreted his description of how to wind it. Therefore my diagram in August is wrong. The correct diagram is in Fig.4, and the device is wound like this, on a 5mm long by 7mm diameter ferrite bead:

(1) Take a small length of wire and poke both ends, one into each hole. (2)

Continued on page 98

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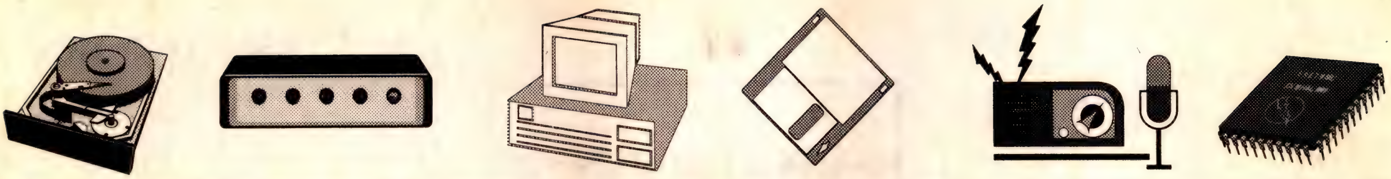

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EA'S COMPUTER BBS

As part of its service to readers, *Electronics Australia* now operates a Reader Information Service Bulletin Board System (BBS). This makes available a wide range of useful information, for convenient access and rapid downloading by readers equipped with a personal computer and modem.

Here's an idea of what's currently available on the BBS:

- Software needed for recent PC-based EA construction projects
- Index files for EA and ETI projects
- Recent notes and errata, both published and as-yet unpublished
- Useful public domain and 'shareware' software for electronics and amateur radio
- General interest shareware utilities, such as the commonly-used compression and decompression utilities.
- The ability to upload Letters to the Editor, and/or contributions to our Forum and Information Centre columns (send them as plain-text ASCII files, please!)
- An on-line 'Discussion Forum' facility, allowing readers to exchange useful technical information directly.

The BBS is ANSI-compatible and is currently operational for virtually 24 hours each day, seven days a week, on (02) 353 0627. Your modem can be set to any standard speed from 300 to 28,800b/s full duplex, with a data format of '8-N-1' (eight data bits, no parity and one stop bit).

So feel free to call up the *Electronics Australia* BBS. Your only outlay will be the usual cost for a phone call to Sydney...

INFORMATION CENTRE

Continued from page 95

Return the two emerging wires on the outside of the core 180° apart. (3) Pass these wires through the holes again and return the emerging wires as in (2).

Repeat step (3), this time taking the emerging wires to the connection points for the incoming coax. (4) Repeat all of this, but at the opposite end of the core for the second winding.

Adding a bit more to the discussion is this letter from a reader who it seems is most familiar with braid breakers:

I go along with both Roger Green and Harry Freeman concerning braid breakers. I have often used a combination braid breaker/high pass filter manufactured by Jenlex in Melbourne for TV receivers. The actualbraid breaker consists of a small ferrite bead, wound with two or possibly three turns of fine wire in the form of a transformer.

It was found that the performance sagged on the top end of the UHF TV band, so Jenlex placed two 2pF (I think) surface mount capacitors to couple the ends of the windings. I also suggest that a high value resistor of between 100k and 1M be wired to couple the braids together, to drain away electrostatic charges that may occur on an antenna.

A braid breaker not only removes the electromagnetic compatibility (EMC) problems for a TV receiver, but for HF amateurs, as most of the line output and pulse mode power supply harmonic energy that goes up the TV antenna is removed, so that harmonics of 15.62kHz cause less problems on 160, 80 and 40 metres. However, you may need to put filters on the mains leads of the TV equipment too. (Rodney Champness VK3UG, Benalla, Vic).

Thanks, Rodney, for describing your experiences with braid breakers. It seems these devices can solve a lot of problems, and that Roger's design is as good as any.

If UHF reception is affected by the braid breaker, as Rodney says, connect 2pF capacitors as shown in Fig.5.

What??

This question comes from Simon Steinfurth (Hurstville, NSW) who responded recently to my request for What questions.

(After nearly 80 of them, I'm finding it very difficult to keep the questions coming, so I would like to repeat my request for more.)

Simon's question (which we received via our bulletin board) is: There are two voltage sources, source M and source A. The voltage at each source is steadily rising at the same constant rate, which means the voltage difference between the sources never changes.

Let the voltage at source M by 24V. If source M is twice the voltage that source A was when source M was at the same voltage source A is now, what is the voltage at Source A?

Answer to September's What??

The answer is 68. Of the 100 people who apply, 17 have no experience in digital, and 25 no experience in analog electronics. This gives a total of 42 people. We are told that 10 have no experience in either analog or digital. Therefore, the number of people with experience in both fields is 100 - 32 + 68. ❖

Electronics Australia's

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SUPPLEMENT

SMA ANNOUNCES ITS NEW 'EMC FRAMEWORK' TO CONTROL AUSTRALIA'S GROWING ELECTROMAGNETIC INTERFERENCE PROBLEMS

REVIEWS OF NEW UNAOHM EP-315A TV/SATELLITE FIELD STRENGTH METER, PC CARD TO TEST IRQ'S & DMA'S

TEST & MEASURING INSTRUMENTS FEATURE

TESTING THE NEW UNAOHM EP-315A TV/SATELLITE FIELD STRENGTH METER WITH ONE OF NINE NETWORK'S 'FLY-AWAY' SATELLITE TERMINALS...

(Courtesy Nine Network, Peter Lacey Services)

NEWS HIGHLIGHTS

OPTUS BRINGS B3 INTO SERVICE

Australia's satellite fleet has been upgraded, with Optus bringing its B3 communication satellite into operation and replacing the eight year old A3 satellite.

B3 was launched by a Chinese Long March Rocket on 28 August 1994. Since then, it has been in a storage orbit, moving slowly into position for transition of services from A3 on August 10 this year.

Optus became Australia's domestic satellite operator in 1992, when it acquired Aussat and its three satellites as part of its $800 million licence purchase to become Australia's second telecommunications carrier.

DSTO DEVELOPS HIGH EFFICIENCY LASER

Australian defence scientists working at Salisbury, SA, have developed a new diode pumped laser, which can operate at 50 times the efficiency of conventional lasers and is more efficient than any other of its kind.

The laser is expected to have broad defence, medical and industrial applications. It incorporates several performance advantages, including a shorter pulse width, higher than average power and greater flexibility in the manufacturing process. The device, which is known as a Co-Planar Pumped Folded Slab (CPFS), generates short pulses at a high repetition.

The first licence on the laser has been given to Vision Systems, makers of the Laser Airborne Depth Sounder (LADS) which is used by the Royal Australian Navy and is on order for the US Navy. Vision Systems is looking to use the device as an enhancement for future generations of LADS. The CPFS has also been licensed to AWA Defence Industries for use in its EAGLE2 laser radar system.

GE PRODUCTS RETURN TO OZ

One of the world's largest consumer electronics companies, Thomson Consumer Electronics has begun operations here in its own right, to market the GE brand in Australia. The company had previously distributed its products via a management agreement with Ricoh.

Thomson Consumer Electronics' General Manager, Mr Paul Hill, says that the company enjoys leading market shares through the world with brands like RCA, GE, Thomson, Ferguson, Telefunken, SABA, and Proscan.

"By introducing new models in colour television, video cassette recorders, audio and communications products, the GE brand can be re-established as a major force in the Australian market. GE will adopt a far more pro-active role in all areas of our business," added Mr. Hill.

"We will be introducing large screen TVs and new VCRs at both ends of the market, followed by new technology products such as Digital Video Disc and Digital TV," he noted.

"TCE's head office and warehouse will be located in Melbourne with branch offices in Sydney and Brisbane, and sales agents in Perth, Adelaide, Hobart and Townsville. We plan to carry large inventories and work closely with

DEFENCE ORDERS SAT COMMS SYSTEM

A team of companies including CSC Australia, Optus and NEC Australia has begun development of a satellite based mobile communications sytems for the Department of Defence. Called the Interim Defence Mobile Communications Network (the Interim DMCN), the system will enable personnel in the Army, Royal Australian Navy and the Royal Australian Air Force to communicate operational and administrative information throughout Australia and 200km out to sea.

As well as providing digital voice, data and fax communications by satellite, the Interim DMCN will connect into the Department of Defence's terrestrial network. It is based on the MobileSat telecommunications system developed over the last four years by CSC Australia, NEC Australia as prime contractor and Optus Communications. MobileSat was launched in August last year and is the world's first commercial mobile satellite communications system.

Under a recently signed contract with NEC Australia, CSC Australia will enhance the existing MobileSat software and integrate it with the computer systems which control and monitor the network.

Final delivery of the Interim DMCN will take place in late 1996 although system trials, using ruggedised terminals and the existing network, took place during the Kangaroo '95 Defence exercises in the Northern Territory during August.

Scheduled to operate for up to 10 years, the Interim DMCN will provide the first stage of a mobile satellite communications network, while Defence examines long term solutions. The Mature DMCN is expected to be delivered in late 1998.

carefully chosen retailers to grow the business together."

BANK HAS ITS OWN TV NETWORK

The Commonwealth Bank will progressively install an interactive business television network to provide the latest communications, training programs and information services for management and staff in its branch network throughout Australia.

It is understood that a total of 138 branches of the Commonwealth Bank in all states will receive the business TV program, beamed by satellite.

Through a streamlined TV system, the new service provides:

- A direct simultaneous transmission of programs to each branch.
- Selective programs to selected Commonwealth Bank outlets.
- Total security for the messages being transmitted.

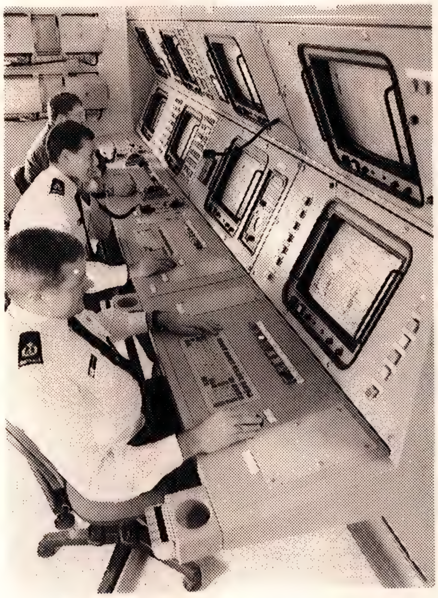
The bank program will be transmitted out of Sydney, via cable to the Optus satellite station at Belrose and then via satellite to each authorised Commonwealth Bank branch throughout Australia.

Security has been achieved through the B-MAC system supplied by Scientific Atlanta Australia, based at Frenchs Forest in Sydney.

The equipment represents a $1.2 million contract with Scientific Atlanta, with the first 2000 units being delivered immediately and the balance of over 1000 B-MAC units being installed progressively at each bank site, over the next couple of months.

SIMULATIONS TRAIN ANZAC SAILORS

The ten ANZAC ships being built by Transfield Defence Systems and electrically outfitted by Siemens Ltd for the Australian and New Zealand Navies are at the forefront of technological innovation, making Navy personnel training essential.



At Transfield's ANZAC Ship Support Centre in Victoria, all 163 ANZAC ship crew members are undergoing various forms of training as part of their duties. This includes 32 engineering department personnel.

Two rooms at the Centre — the Machinery Control Room (MCR) and a Substations room — are being used to train Navy engineers to use new equipment, by simulating ship conditions.

All Siemens' equipment in the Centre, including dual local area networks (LAN) and software, is identical to systems fitted on the ship. Siemens also designed and built the MCR propulsion console, which monitors two propulsion diesels and a gas turbine, that feed through an intricate arrangement of gears to two propeller shafts. While innovative software helps monitor 4300 temperatures, pressures, levels, engine speeds and status indicators given by a simulated field environment during training.

A Software Development Unit also located at the Centre can be used to make changes in Siemens supplied software, allowing ship equipment operation improvements to be easily implemented. The Centre can then be used as a test bench. Modified software can be tested in isolation with other equipment before finally being installed on the ship.

The ANZAC Ship Support Centre is expected to remain open for the full life of the ANZAC ships, giving both Navies the opportunity upgrade ship systems and control software, and to meet the challenge of future technology.

AUSTRALIAN D-G FOR INMARSAT

Inmarsat Council Chairman Ronald J Mario has announced the appointment of Warren Grace of Australia as Director General of Inmarsat.

Mr Grace was formerly Managing Director International for Telstra, where he oversaw Telstra's international net-

SMA LAUNCHING 'EMC FRAMEWORK'

Around the world, there is increasing awareness that the rapidly expanding use of electronic and electrical equipment is bringing with it a growing electromagnetic interference (EMI) problem. Spurious emissions from many kinds of equipment are degrading the performance of other equipment, while new equipment can cause malfunction of existing systems which were never designed to cope with its emissions. In any case the 'noise floor' in modern cities is steadily rising, and degrading the performance of many telecommunications systems.

It's clear that there is a pressing need for a regulatory framework to manage this growing electromagnetic compatibility (EMC) problem, and Australia's Spectrum Management Authority (SMA) has taken the initiative by developing a new 'EMC Framework' to achieve this gaol. It has announced that on January 1, 1996 the framework will be introduced, setting limits not only on RF emissions *from* new products, but also levels of *protection against emissions for susceptible new products. The framework will eventually cover almost all new electrical and electronic products offered on the Australian market.*

Australia's EMC Framework will be closely aligned with emerging international systems for EMC management, including standards and compliance arrangements. The latter have been designed to reduce direct outlays and minimise delays in bringing products to market, by using a Supplier's Declaration of Conformity as the primary means of market access.

The SMA has consulted at length with industry during the development of the framework and this involvement is expected to continue, in order to maximise Australia's EMC management while minimising any consequent increase in costs or delays associated with product development and marketing.

The Australian Electronics Development Centre (AEDC) has been closely involved, along with the Department of Industry, Science and Technology (DIST), and five endorsed 'EMC Networks' have been set up to transfer EMC knowledge — including all technical, regulatory and trade issues, to manufacturers and distributors. The networks will also provide an organised structure for network members to identify and work together on specific EMC issues. AEDC's executive director Ms Deborah Davis said that "The EMC Network initiative is an excellent example of how Government, industry and regulatory bodies can all work together as an effective partnership that will benefit all concerned."

AEDC has also designed courses to provide the technical and design personnel of Australia's electronics manufacturing and distribution companies with up to date information on EMC compatibility.

Further information is available from the AEDC at PO Box 323, Broadmeadows 3047; phone (008) 339 601 or (03) 302 1422, or fax (03) 302 1201.

works and operations, international correspondent relations and the development and management of offshore businesses. Previously, from 1987 - 1990, he was Managing Director of McDonnell Douglas Information Systems in Australia.

Mr Grace said he was delighted to be joining Inmarsat. "The global mobile satellite industry has become a challenging but potentially very rewarding arena and I look forward to helping Inmarsat continue as a strong successful competitor as the industry and the markets change."

The Director General is the Chief Executive and the legal representative of the organisation. The appointment is for a six year term.

ADAPTEC ACQUIRES FUTURE DOMAIN

Computer I/O specialist Adaptec Inc has acquired Future Domain Corporation of Irvine, California in a US$25 million cash transaction. Future Domain, a privately held company founded in 1983, designs, manufactures and markets desktop input/output products.

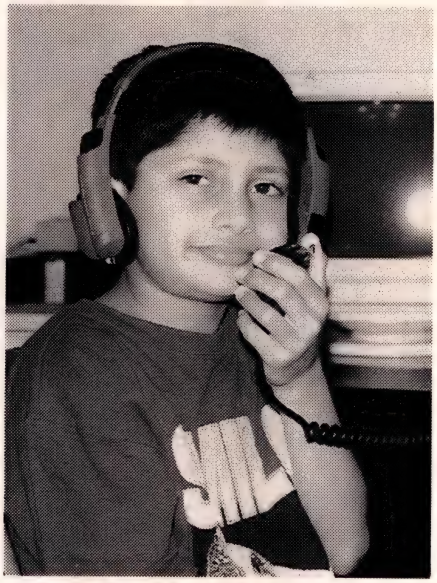
According to F. Grant Saviers, Adaptec chief executive officer, the acquisition of Future Domain is significant for a couple of reasons. "This addition adds complementary products to our portfolio, and offers customers a new and synergistic set of I/O solutions. Secondly, Future Domain's software and hardware architecture teams will have the strategic charter to deliver processor indpendent solutions for the RISC based systems market, enhancing existing Adaptec development efforts."

Jack Allweiss, president and CEO of Future Domain, said: "We are very pleased. We belive the customers of both Adaptec and Future Domain and the I/O market in general will greatly benefit from this combination." Allweiss will serve as director of the Irvine Product Development Centre.

Founded in 1981 and headquartered in Milpitas California, Adaptec is a recongised market leader in high performance I/O technology. The company currently employs approximately 1800 people, and with its global distribution network, serves customers worldwide. Adaptec's World Wide Web home page address is http://www.adaptec.com and will soon be available through the Anabelle Bits local site. Anabelle Bits is the Master Australian distributor of Adaptec SCSI products.

AUSTRALIA'S YOUNGEST RADIO AMATEUR

Young Ved Kamat, of Wollstonecraft in Sydney, is only eight years old but has become Australia's youngest licensed Radio Amateur operator (and also amongst the youngest in the world). Ved has his own Call sign VK2LAD, and an Amateur Operator's Certificate of Proficiency.



To get his licence Ved had to pass an Electronics Theory exam, Operating Regulations and Procedures exam, and Morse Code Sending and Receiving exam (all with at least 70% pass).

Proud father Gopal Kamat VK2WGY explained "When Ved was six, we gave him an Electronics Hobby Kit. We were amazined to see him wire up about a hunderd wiring connections and lots of parts (sometimes deciphering schematic diagrams) to make hobby projects — which often worked the first time!

Ved is a cheerful and popular student at the International Grammar School (Year 4) and has also learnt Japanese (which he can read and write and do basic conversation in, and now knows over a hundred Kanji characters). He is fluent in written and spoken Marathi (an Indian language) and also knows some Hindi (another Indian language) and is learning Italian as a third language at school...

His hobbies are reading, karate, (he has an orange belt), swimming, computers, chess and the piano.

NEWS BRIEFS

- Bob Mounic has been appointed Director Business Development of ***Sun Microsystems.***
- ***Tech-Rentals*** has opened an office in Kuala Lumpur to serve the Malaysian market.
- Benchmarq Microelectronics has appointed ***Reptechnic*** as the Australian distributor for the company's range of ICs and modules.
- Mr Dick Simpson has been appointed Director of Products for ***Optus Communications.***
- ***Intel Australia*** has moved to Level 2, 8-22 West Street, North Sydney 2060; phone (02) 9937 5800.
- Z-World Engineering, located in California has recently appointed ***Dominion Electronics*** as an Australian distributor for its range of microcontrollers and software. Dominion can be contacted by phone on (02) 906 6988 or fax on (02) 906 7145.

EUROPEAN MERGER FOR CABLE TV

Philips Media, the interactive software and media services division of $60 billion NLG Dutch electronics company Philips, and United International Holdings, Inc (UIHI) of Denver, Colorado, have announced the closing of their transaction to combine the European cable television interest of both companies in a 50/50 joint venture.

The new organisation to merge from this agreement, United and Philips Communications B.V. (UPC), is now the largest private cable television operator in Europe.

UPC has ownership interests and provides management services to multichannel television operating systems throughout Europe including Austria, Belgium, the Czech Republic, France, Germany, Hungary, Ireland, Malta, the Netherlands, Norway, Portugal, Sweden and Spain, as well as Israel. The company, at its inception, has a subscriber base of more than two million of the three million homes currently passed by its systems.

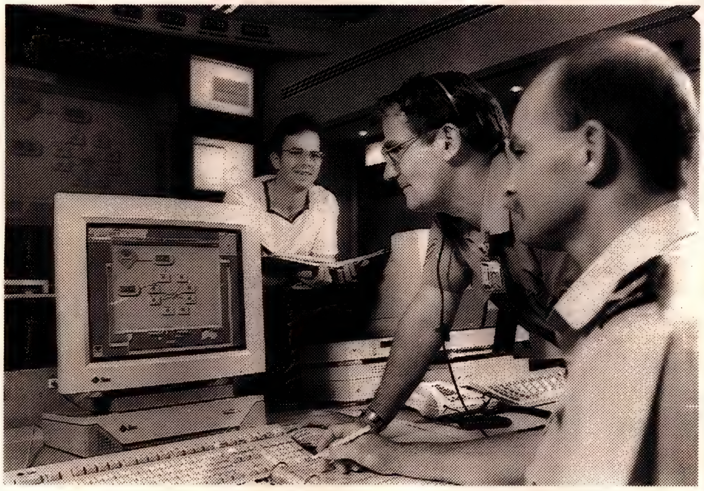
Based in New York, Philips Media has worldwide responsibility for Philips Electronics' interests in consumer and professional multimedia software development and distribution, electric distribution as well as an expanding portfolio of new media services.

UIHI is a leading provider of multichannel television and related communication businesses outside of the

TELSTRA DELIVERS DSDN NERVE CENTRE

Telstra Applied Technologies, prime contractor for the Defence Switched Data Network (DSDN) has commissioned the Network Operations Centre for the DSDN at Canberra's Deakin Offices.

DSDN is the primary Australian Defence Communications network, and supports the overall Defence strategy of integrating the present myriad of information and communications systems so that they can intercommunicate.



Chief of the Australian Defence Force, General J.S. Baker said that further development of DSDN would enable Defence to achieve "the goal architecture of being able to run any approved application program, whether it be voice, video or data, from a single terminal on every desk."

The Network Operations Centre (NOC) comprises an operations room and support facilities staffed by about a dozen Service personnel and is equipped with intelligent workstations and large screen displays.

Real time supervision and control of network traffic in all operational situations maximises the efficient use of network assets and minimises down time due to faults. An extended-hours help desk is provided for network users.

In addition to DSDN, the NOC manages the Backbone Router System, the Defence Security Management Sydney, and the Defence secure gateways to non-Defence users.

DSDN comprises two physically separate networks, DEFAUSNET (for carriage of Unclassified and Restricted traffic) and DEFSECNET for Confidential and Secret traffic).

These networks will be integrated when adequate security arrangements are in place, allowing the DSDN to evolve into a single nationally-managed wide area network connecting all 1500 Defence establishments. Currently DSDN has more than 3000 ports and tens of thousands of users within Defence. DSDN now extends to Washington, London and Butterworth, Malaysia.

The network supports a comprehensive range of data transport protocols including X.25, X.28, SNA/SDLC, IP/IPX, Token Ring, Frame Relay and X.400 electronic mail networks. As NorTel is committed to providing a migration path for the existing Passport equipment to Asynchronous Transfer Mode, DSDN will be able to migrate to multi-media applications in the future.

United States. In addition to its interest in UPC, UIHI has ownership interests in and provides management services to multi-channel televsion systems operating or under development in 10 countries throughout Latin America and Asia/Pacific, covering in excess of four million homes in franchise areas.

HIGH-TECH KITS FROM ACTIVE ELECTRONICS

While High-Tech Tasmania proprietor and EA columnist Tom Moffat is working in the USA, his electronics kits are being distributed by Hobart electronics dealer Active Electronics.

Active has been the primary supplier of 'raw materials' for the kits ever since Tom began marketing his designs, and the firm is very familiar with them; now they've taken over manufacture and distribution as well.

The following kits are currently available for use with IBM compatible PCs: Listening Post II, for weatherfax, radioteletype and Morse code reception; Listening Post Wesat, for weather satellite decoding; and the Pocket packet modem kit, for packet radio communication.

The kits can be supplied either by mail or personal purchase from Active Electronics' shop at 320 Elizabeth Street, North Hobart, Tasmania 7000; phone (002) 31 0111. And at long last, all major credit cards can be accepted.

Tom Moffat is planning to work on further projects while he's away, as well as continuing to contribute his popular columns and articles for *Electronics Australia.*

AUSTRADE OFFICE IN SILICON VALLEY

In a move to accelerate the successful entry of Australian information technology firms into the United States market, Austrade is joining forces with private Australian companies in Silicon Valley, California, the heart of the American computer and electronics industries.

Award winning Australian firms such as Intellect Australia and an Australia-America Chamber of Information Technology are now co-located with Austrade in San Jose.

Minister for Trade, Senator Bob McMullan, opened Intellect Australia's United States headquarters in San Jose during August.

Initiated by Austrade, the strategic shift reflects not only increased numbers of Australian software, hardware and telecommunications firms committing to the United States market, but a trend towards closer cooperation between Austrade and private industry. In practical terms, the new arrangement means that Australian companies can move quickly into the North American market.

"In this industry, where winows of opportunity open and close very rapidly, the nation of a walk-in export office is very appealing to Australian IT firms", says Dr Robert Hunt, Austrade San Jose Trade Commissioner overseeing the Business Centre move.

"Silicon Valley is the most attractive entry point for Australian firms," said Hunt. "Information technology is the world's fastest growing industry and the US market accounts for fully half the world's sales of software. Revenues of this area's top 150 companies exceed US$110 billion, one third the GDP of all of Australia".

Australia aims to quadruple exports of computer hardware and software by the turn of the century — to more than $8.5 billion. ❖

T&M Instrument Review:

The Unaohm EP315A TV/Satellite FS Meter

Among the many features of the Unaohm EP315A Field Strength Meter is its inbuilt 'satellite IF' tuner, covering the 950-2050MHz band as well as the usual VHF and UHF bands. It can also power a standard satellite LNB directly, for speed and convenience. Other features include digital frequency readout and inbuilt spectrum analyser and TV receiver functions.

by JIM ROWE

The products of Italian test instrument manufacturer Unaohm may not be widely known in this part of the world as yet, but they've become widely used throughout Europe. And now that they're being promoted by energetic Melbourne distributor Peter Lacey Services, it's likely that they'll establish a name for themselves here as well.

The new EP315A TV/Satellite Field Strength Meter makes an excellent representative of the Company's instrument range. Solidly built and clearly designed for a high level of reliability in the field, it also offers a surprising array of functional features and facilities.

As the name suggests, it's designed to cover not just the standard VHF and UHF TV bands, but also the 950 - 2050MHz band used as a 'tuneable first IF' by satellite TV receivers. Since satellite delivery of Pay TV is just beginning here now, this facility should make it of particular interest to antenna installers hoping to expand their range of services into this area.

Perhaps not surprisingly, the EP315A doesn't just provide the facility to measure signal strengths in the satellite IF band. To make it really useful as an aid to dish and LNB alignment, it also has the ability to provide the LNB's +13V/+18V DC power directly via the IF cable, in the same way that power is normally supplied by the receiver. This means that it can be used to optimise the dish and LNB alignment on the spot, even before the downlead and receiver are installed.

Rather than simply indicating the strength of signal carriers on a meter, the EP315A displays them on a CRT screen, in the manner of a spectrum analyser. This makes it easy to adjust dish aiming, LNB polarisation — and on the other bands, antenna orientation — for optimum reception. Not only that, though, but there's an optional audio oscillator with its frequency controlled by the received carrier level — so you can perform alignment very easily by *ear*, without having to look down at the screen all the time.

In addition, the EP315A also has an inbuilt TV receiver, with the ability to display the received images on screen to give a better idea of reception quality. You can even display the horizontal sync pulse and colour burst in a small 'window' on the left-hand side, to get a fast indication of signal distortion, while a horizontal bar across the top indicates signal level in conjunction with the graticule scale.

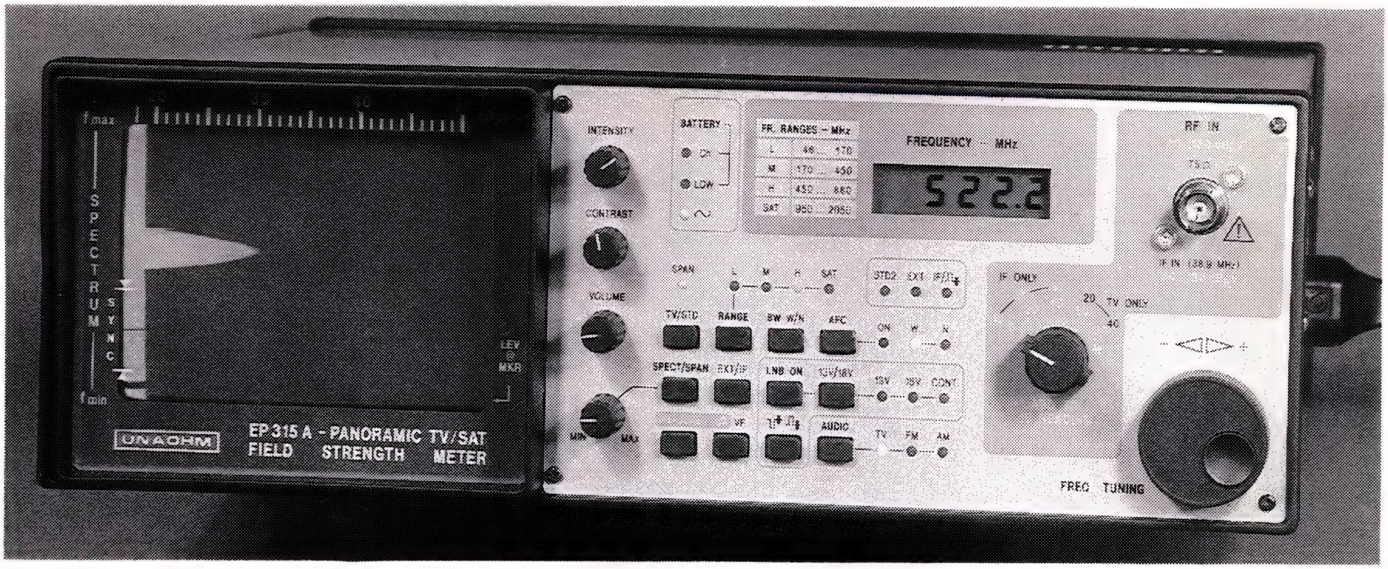
Sound can be monitored as well as picture, and for satellite reception there's even the ability to tune in sound subcarriers anywhere in the range 5.5 - 9.5MHz.

Despite its wide range of functions and facilities, operation of the EP315A is very intuitive — thanks to the well-planned front panel layout. A bank of 12 pushbuttons is used to select most of the operating modes and ranges, with some 20 accompanying LEDs to indicate operating status. Four small knobs down the right-hand side of the screen are used to control CRT brightness and contrast, sound volume and sweep width when you're in spectrum analyser mode.

A large rotary knob at lower right, operating a 10-turn pot, is used for tuning, while an adjacent smaller knob selects measuring attenuator settings. The main RF input is at upper right on the front panel.

As the EP315A is designed for both field and lab work, it can be powered

Michael Landy of the Nine Network's satellite operations division checks out the Unaohm EP315A with one of the network's 'fly away' satellite terminals, close to the base of the Channel 9 VHF transmitting tower.



from either an internal rechargeable battery (either lead-acid or NiCad), the AC mains or an external DC source (11.5V - 15V). A battery charger is inbuilt, and both battery level and charging status are displayed clearly via front panel LEDs.

A small panel on the side of the instrument provides the external power inputs and power switches, while an adjacent panel provides some auxiliary controls and connectors: the satellite sound subcarrier tuning control, satellite baseband video de-emphasis switching, and both BNC and SCART outputs for driving external monitors and decoders. There's also an 11V DC output jack capable of supplying up to 100mA.

The monochrome CRT used in the EP315A has a flat screen measuring 114mm (4.5") diagonally. The field strength/spectrum analyser display is orientated horizontally, with a baseline on the left and signal peaks extending to the right. A graticule scale along the top of the screen provides a basic 30dB measurement range, and is used to measure signal levels in conjunction with the measuring attentuator. The vertical display axis represents frequency, with lower frequencies at the bottom and higher frequencies at the top.

Incidentally the video monitor section of the instrument can be used to display external composite video, if required, fed in via the SCART connector.

Impressive specs

The four main bands covered by the EP315A are low VHF (46 - 170MHz), high VHF/UHF (170 - 450MHz), high UHF (450 - 860MHz) and satellite (950 - 2050MHz). There's also a band covering the European standard IF range based on a video IF of 38.9MHz. The centre frequency/receiver tuning frequency is indicated on a five-digit LCD display.

The rated measuring range of the instrument on these bands is from 20 - 130dBuV (-90 to +20dBm) on the VHF and UHF bands, from 30 - 130dBuV (-80 to +20dBm) on the satellite band, and from 60 - 130dBuV (-50 to +20dBm) on the IF band. The measuring attenuator covers from 0dB to 80dB in five ranges on the RF bands, and from 0dB to 40dB in three ranges on the IF band.

Rated measuring accuracy on the VHF, UHF and IF bands is +/-1dB, while on the satellite band it's +/-1.5dB. This is achieved by maintaining the effective response of the instrument within +/- 1dB throughout its measurement range, using an inbuilt digital correction table.

The quoted measurement bandwidth of the EP315A is either 100kHz or 1MHz selectable on the VHF/UHF/IF bands, and 9MHz on the satellite band.

In spectrum analyser mode, the sweep range or span can be continuously adjusted between 10% and 100% of the band being used.

When you're operating in this mode the tuning control manipulates a marker signal 'line', whose frequency is indicated on the LCD readout. A horizontal band mimics the signal amplitude at the frequency cursor, to facilitate level measurements — although in this mode the band is along the *bottom* of the screen, rather than at the top and near the graticule scale.

Matching generator

Unaohm also makes a matching wideband noise generator, the NG752-75, which can be used with the EP315A in spectrum analyser mode to perform pseudo-sweep analysis of RF amplifiers, filters, diplexers and similar equipment. The combination can also be used to measure cable attenuation, prepare matching stubs, measure the input and output impedance of RF equipment, antenna SWR and so on.

The NG752 produces an output which is substantially flat between 50MHz and

A pair of small panels on the right hand side of the meter provide connections for either AC or DC power input, video base band output and SCART video input and output — plus controls for battery charging and satellite sound carrier.

2GHz, at an impedance of 75 ohms. The nominal output level for a 0.5MHz bandwidth is 90dBuV as measured with an envelope detector as used in the FSM. It's provided with an output attenuator giving three independent factors of 20dB, 10dB and 6dB — or a total of 36dB when used together. The output noise can also be optionally modulated with an audio tone, if desired.

The NG752 has a mains power supply and is again quite rugged in construction.

Trying them out

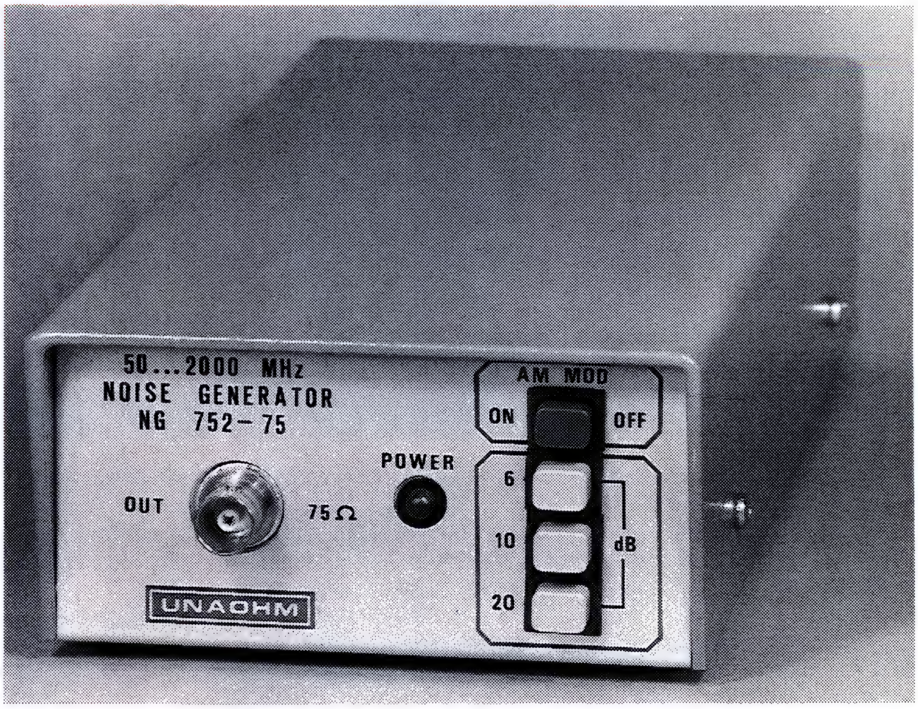
Thanks to distributor Peter Lacey, we were able to try out a sample EP315A Field Strength Meter and NG752 Noise Generator for a couple of weeks, to get a good 'hands on' impression of their operation and ease of use. We found both instruments very convenient and intuitive to use, and this coupled with their many features left an excellent impression.

Using the two instruments together, to get an idea of the effective 'flatness' of the combination over the bands covered, we obtained figures of within +/-1.5dB between 48MHz and 170MHz, within +/-3dB between 160MHz and 460MHz, within +/-2dB between 450MHz and 870MHz, and within 4dB between 850MHz and 2050MHz. Generally the responses were quite smooth over each band, although there were a few minor bumps and dips in the satellite band.

Using the EP315A it proved to be very easy to measure the field strengths of all the VHF and UHF signals available in our area. We were also able to try it with a satellite dish and Ku-band LNB, and again it was surprisingly easy to measure the IF carrier strengths for the various active transponders on Optus B1.

It was very nice to be able to switch the EP315A into receiver mode, for both terrestrial and satellite signals, and check the reception quality. We also particularly liked the 'Measurement' option in receive mode, where you can display both the signal strength and the sync pulse/burst waveform as well as the picture itself. This is a most informative display, and one that is excellent for optimising reception.

We didn't have a chance to use the audio tone facility ourselves for lining up a satellite dish and LNB, but as events transpired we *were* able to get an excellent demonstration of its use. Just before we were due to send the EP315A back, Peter Lacey advised us that it would be going directly to the Nine Network, for testing by the Network's Satellite Operations division. As a result, we were able to arrange with the division's Michael Landy, to see it being tried out with one of the Network's 'fly away' transportable satellite earth stations.



The matching NG752-75 noise generator provides broad band white noise signals over the range from 50 to 2000MHz, with an output of 90dBuV.

Mr Landy explained that these stations are used for establishing ad-hoc satellite links, when important news stories break in remote areas. They consist of a segmented 2.5-metre dish, a manually steerable mounting and base with LNB assembly and diplexed transmit/receive feed, a complete solid state Ku-band receiver and transmitting exciter and a travelling-wave tube power amplifier with 300W maximum output. Everything fits into a set of sturdy carrying cases for transport.

Needless to say, unpacking the station and setting it up for operation can take quite a while. Apart from anything else, the dish and base must be carefully assembled, and then aimed accurately at the 'bird' to be used for the link. This last step alone can take a significant time — most frustrating when you want to beam back an urgent item for the next news broadcast.

Michael Landy particularly wanted to see if the Unaohm EP315A could be used to speed up this aiming step, and this certainly turned out to be the case. In fact as he demonstrated to us, the EP315A's audio tone facility made dish and feed horn alignment very fast and efficient.

We were convinced, and so was the Nine Network — we gather they decided to buy a couple, for use in setting up their satellite links!

In summary, then, the Unaohm EP315A TV/Satellite Field Strength Meter seems a particularly powerful and flexible instrument. It's also both rugged and easy to use, which should make it of value for anyone from TV antenna and Pay TV dish installers right through to the satellite news gathering departments of TV stations.

For the quoted price of $4300 (plus tax where applicable), it should be a very worthwhile investment for any professional working in this area.

The matching NG752-75 Wideband Noise Generator carries a price of $915 — again plus tax where applicable. It too seems a very well made unit, and should be a very useful accessory for more detailed analysis of filters, amplifiers and other elements.

Further information on these and other instruments in the Unaohm range is available from Peter Lacey Services, 80 Dandenong Road, Frankston 3199; phone (03) 9783 2388 or fax (03) 9783 5767. ❖

No Other DMM Compares!

The Metrix MX56 is, without question, one of the world's finest digital multimeters. The best of the ASYC II Series, it has the best accuracy (50,000 count/ ±0.025%), a built-in counter, displays True RMS AC (and AC+DC) voltage as resistive power or dB (impedance selectable), mains disturbance indication and much, much more. The ASYC II Series has been designed to provide IEC1010 category safety for the user with separate battery compartment, leads that won't accidentally be disconnected, 600V fuses, metal oxide varistors, holster and sealed cases, double insulated (IP677) and waterproof to 10m.

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Indicates the presence of spikes or noise on the line, enabling the user or technician to determine if more sophisticated monitoring equipment is needed.

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For accurate measurements of non-sinusoidal waves, the ASYC II series displays True RMS readings for AC or AC+DC.

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The meter performs the dB or power calculation and you select load impedance from 1Ω to 9999Ω in 1Ω steps.

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You can measure currents from hundredths of a microamp to half an amp without changing the jack or switch position with electronic auto-ranging.

High Accuracy Temperature Measurement

By simply adding a Metrix PT100 or PT1000 Temperature Probe directly into the meter's jacks, measurements to 800°C, with an accuracy of 1°C over the entire range can he made easily.

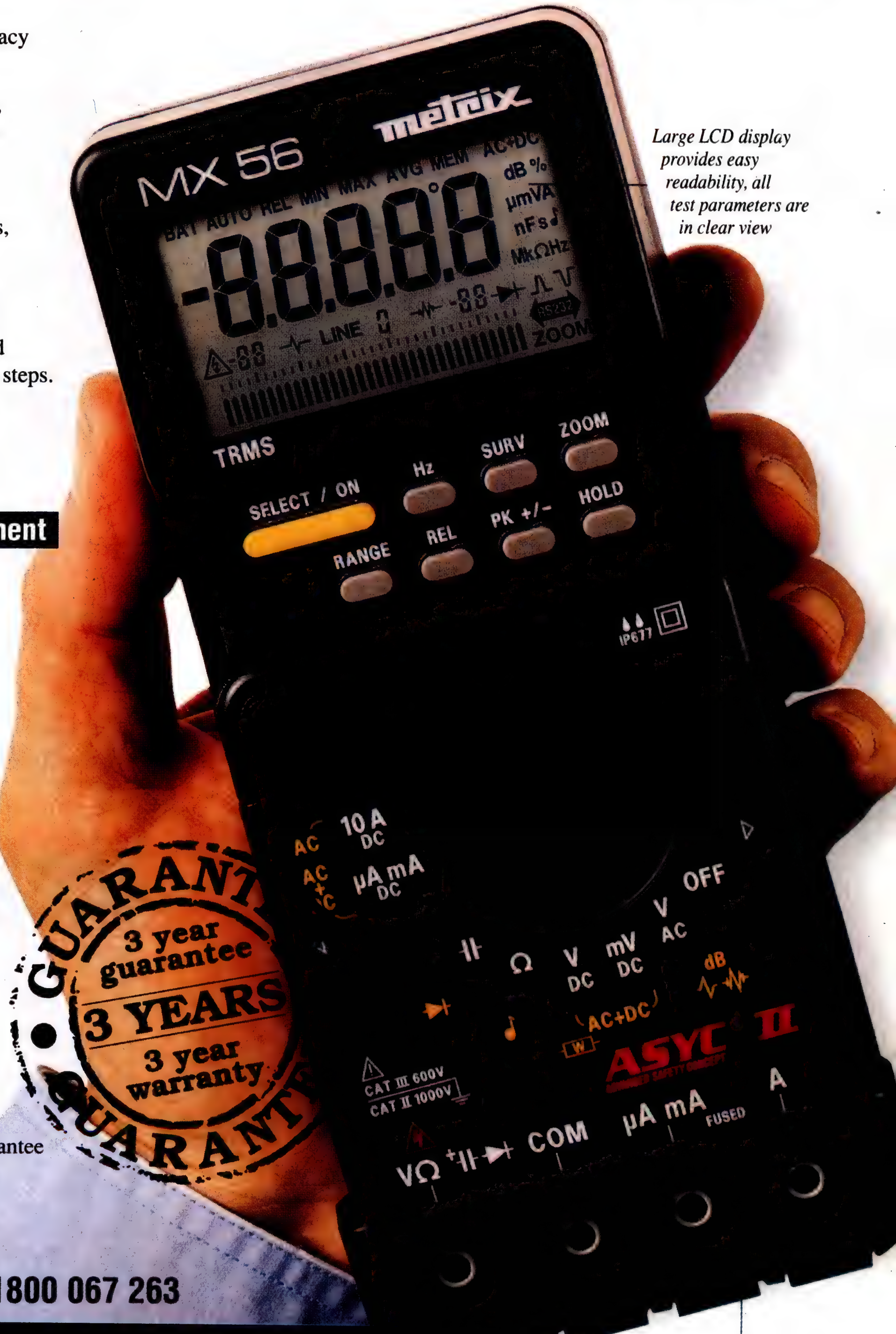
Traceability & Calibration

Each ASYC II DMM is provided with a Declaration of Conformity and Test Report for traceability to national and international standards. Re-calibration is digital via a serial interface without opening the meter and takes just 7 minutes in our NATA Cal. Lab!

Performance Choices

	MX53	MX54	MX55	MX56
Basic Accuracy (%)	0.1	0.05	0.025	0.025
T RMS Bandwidth (kHz)	30	100	100	100
Min/Max/Average		yes		yes
Event Counter				yes
Disturbance Indicator		yes		yes
dB		yes	yes	yes
Resistive Power				yes
Temperature		yes		
50mA Accuracy (%)	0.2	0.05	0.05	0.05

All ASYC II meters have a 3-year replacement guarantee (If it fails – you get a brand new meter!). Prices start at $470.



Large LCD display provides easy readability, all test parameters are in clear view

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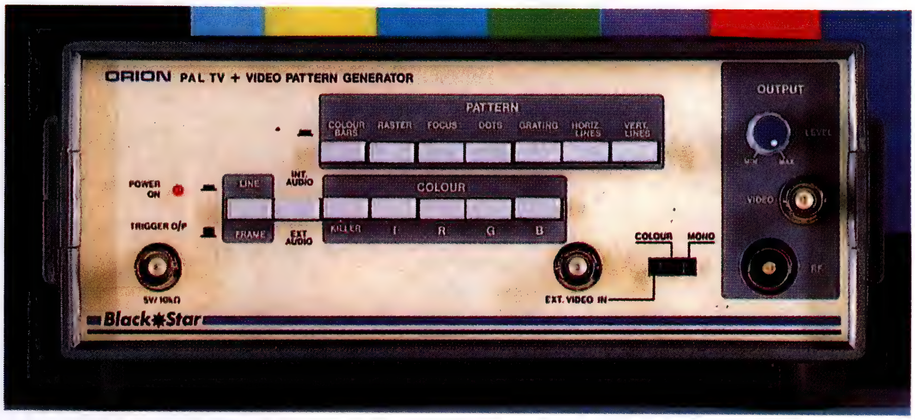

PAL TV/video pattern generator

The new Orion video pattern generator from Black Star is a compact bench instrument offering a wide range of patterns and facilities.

Incorporating RF, composite video, RGB and sound outputs, the Orion is suited to testing and servicing TV receivers, computer and video monitors. More than 50 pattern combinations can be selected, including those for testing static and dynamic convergence, video amplifier linearity, colour purity, focus and general colour performance. TV systems covered by the instrument include PAL B, D, G, H, I and K, as dictated by the sound carrier.

The RF output is tuneable over VHF band III for channels 5 - 12 with a carrier level of at least 10mV, and UHF bands IV and V covering channels 28 - 69, with more than 1mV of carrier level. The sound carrier is switchable between 5.5MHz, 6MHz and 6.5MHz

The generator also has flexible IRGB outputs, ensuring compatibility with most video monitors. It incorporates a sepate video input to modulate camera signals, a fully variable output for video level and a trigger output for scope triggering on complex waveforms.

An external sound modulation input DIN connector also allows the instrument to be used for frequency response testing of TV sound systems.

For more information circle 201 on the reader service card or contact Obiat, PO Box 37, Beaconsfield 2014; phone (02) 698 4111.

Programmable multimeter

The 3000 series of programmable multimeters from Meter International allow the setting of low and high levels of current, voltage or resistance. When a measurement falls within the set values, a warning tone is sounded. This can free an operator from referring to the display when looking for a particular measurement.

The automatic data hold allows the operator to concentrate

Smaller, lighter Yokogawa DSO

The DL1540 is a long record length, 150MHz four channel digital oscilloscope with a maximum sample rate of 200MS/s. It has a high speed update rate irrespective of the number of channels in use and also acts as a recorder capable of capturing very fast surge signals.

Pulses as short as 20ns can be recorded in real time on an optional built in printer.

In single shot applications, up to 120K word length is available, and since the signal is first stored in memory, a fast sampling speed can be used, enabling signals of tens of MHz to be printed out.

The scope has a built in 3.5" MS-DOS compatible floppy drive, to allow waveform data, panel settings and display to be saved and later included in a word processor document. A history memory function stores the last 100 displays and the instrument has a sophisticated range of trigger functions including window and TV triggers.

For further information circle 202 on the reader service card or contact Yokogawa Australia, 25 - 27 Paul Street North, North Ryde 2113; phone (02) 805 0699.

on probe placement, updating the display every three seconds on valid inputs. A beep indicates the reading is locked in. This feature significantly reduces measurement difficulty in confined areas and increases safety when measuring dangerous voltages.

A special feature of the MIC-3130, a new addition to the range, is built-in support for K or J type termocouples, with the display showing either °C or °F. The meter can also measure capacitance from 1pf to 4uF over four ranges. A frequency counter to 4MHz is also included. The unit comes in a rugged case with pushbutton range selection. The display has large 4000 count digits with range annunciators. A bar graph is incorporated into the display.

For further information circle 204 on the reader service card or contact Computronics International, 31 Kensington Street, East Perth 6004; phone (09) 221 2121.

Clamp-on AC/DC milliamp meter

The new F.W. Bell model mA-2000 measures low level AC and DC currents from 0 to 2000mA with a resolution as low as

VXI waveform analyser

The new TVS600 series VXI waveform analyser from Tektronix is claimed to have the fastest waveform acquisition performance in VXI format currently available. It has a sample rate of five gigasamples/second on four channels simultaneously, with a 1GHz bandwidth and eight bits of vertical resolution. It is also fully VXI 'plug and play' compliant.

The TVS621 and TVS641 analysers are C-size VXI cards with two or four input channels respectively. Both modules incorpoirate a digital real time signal acquisition engine, derived from the TDS600 benchtop DSOs, and have 250MHz bandwidth, simultaneous 1GS/s sample rate and 15K record length.

For advanced research applications, the TVS625 and TVS645 waveform analysers provide two or four input channels respectively. Both modules are C-size VXI cards and feature a 5GS/s sample rate, 1GHz bandwidth and 15K record length.

These modules can capture signals on all channels simultaneously with 200ps/point time resolution.

For further information circle 206 on the reader service coupon or contact Tektronix, 80 Waterloo Road, North Ryde 2113; phone (02) 888 7066.

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Sampling Rate	20Ms/s	20MS/s	20MS/s
Input Channels	2	2	2
Record Length/Channel	2k	2k	2k
Save Ref. Memory	Yes	Yes	Yes
Cursor Readout	Yes	Yes	Yes
B Sweep Function	Yes	Yes	Yes
RS-232C Interface	Yes	Yes	Yes

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3203	20V	3A	6302	±30V	2A	5V	5A
3302	30V	2A	6303	±30V	3A	5V	Up 5A
3303	30V	3A	6306	±30V	6A	5V	from 5A
3601	60V	1A	6603	±60V	3A	5V	3A 5A
3306	30V	6A					
3603	50V	3A					
33010	30V	10A					

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0.1mA, and is ideal for milliamp level measurements without interruption of circuits. The instrument measures True RMS for up to 40kHz signals. A BNC connector provides a waveform output suitable for oscilloscopes and recorders. Basic DC accuracy is 1% of reading.

For further information circle 220 on the reader service coupon or contact Nilsen Technologies, 150 Oxford Street, Collingwood 3066; phone (03) 9419 9999.

Power and energy calibrator

Rotek Instruments has introduced the new model 8000 Power and Energy Calibrator, which is a high precision source of AC voltage, current and phase angle designed for calibrating watt, VAR, watthour, volt, amp and phase angle meters and transducers. The 100ppm accuracy of the 8000 is traceable to the US NIST.

The voltage range is from 1V to 700V, current 1mA to 200A, frequency 25Hz to 1kHz, power 1mW to 140kW and phase angle +/-180°. Output settings and menus are displayed on two large LCD graphics displays.

Power can be displayed in units of watts, VARs or VA. Phase angle can be displayed in units of power factor, degrees or radians. Transducer calibration is simplified by an inbuilt 4.5 digit multimeter which can monitor transducer outputs from 0 to 25mA, 0 to 1000V and frequency to 100kHz. All parameters and functions of the model 8000 can be remotely controlled via an IEEE488.2 interface.

For further details circle 207 on the reader service coupon or contact The Dindima Group, PO Box 106, Fermont 3133; phone (03) 9873 4455.

Locates faults in HV cables

The HDW system 2000 high voltage cable fault location system provides a safe, easy and quick technique for locating any type of fault with a minimum of stress to the cable under test. A high voltage pulse echo technique is used.

The system comprises a surge pulse generating 'thumper' and a time domain reflectometer (TDR) with an arc reflection filter. The TDR monitors the thumper's discharge into the cable, detects when a breakdown of the fault occurs, and immediately measures the distance to the flashover point.

An ajustable energy surge pulse of up to 800 joules of energy and up to 15kV of potential is available to detect intermittent cable faults.

The TDR has measuring ranges from 50 to 10,000 metres with an accuracy of 2% of range. The system provides for automatic cable discharge and a single point safety ground for maximum operator safety.

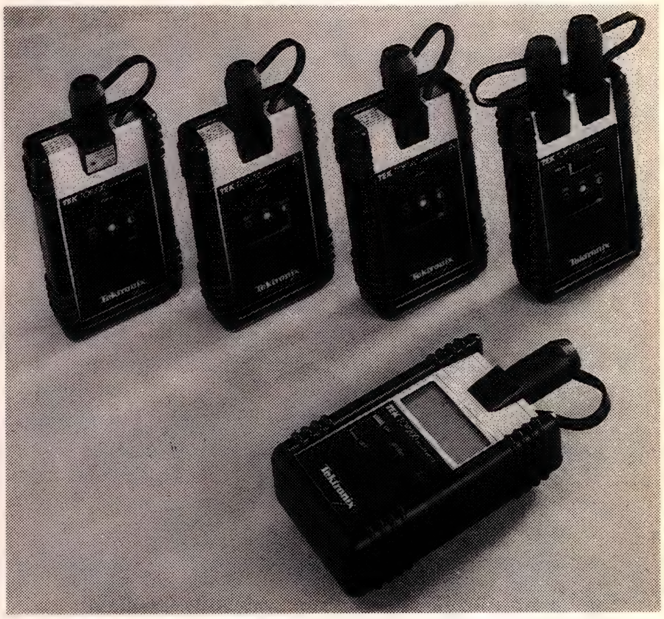
The thumper may also be used indpendently for high voltage proof testing at up to 40kV and also for high resistance fault burning. Tech-Rentals offers the HDW System 2000 for hire for periods of one day or more.

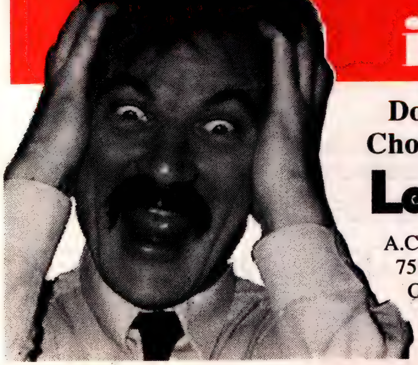
For further information circle 209 on the reader service coupon or contact Tech-Rentals, PO Box 621, Ringwood 3134; phone (03) 879 2266.

Handheld optical test instruments

Tektronix has introduced a new line of handheld optical test products that include the TOP130, TOP140 and TOP150 optical light sources; the TOP200 power meter; and the TOP300 visual fault finder.

The optical light sources are designed for different applications. The TOP130 emits at 850/1300nm and is suitable for testing multimode cable typically used in LANs and WANs; the TOP140 laser source emits at 1310nm; and the TOP150 laser source emits at 1500nm. The latter two models are for





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READER INFO NO. 22

testing single mode cables used by Telco and CATV network operators.

The TOP200 optical power meter is a low cost, palm size unit that makes basic optical power measurements in either dB or dBm, calibrated at 850nm, 1300nm and 1550nm. This power meter provides a high resolution of 0.01dB and allows the user to store reference values for each wavelength independently.

The TOP300 visual fault finder employs a very efficient laser diode operating at short wavelengths. The diode emits a highly visible red light, useful for checking continuity and fibre integrity over short distances where OTDRs cannot be used effectively. With an emission wavelength of 635nm, difficult to locate fibre breaks are easily detected.

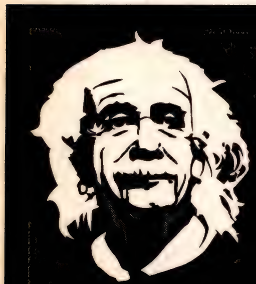
For further information circle 215 on the reader service coupon or contact Tektronix, 80 Waterloo Road, North Ryde 2113; phone (02) 888 7066.

Ultra compact Pocket DMM

Pantec's 3060B digital multimeter is a slim, compact unit that can be easily carried in a short pocket yet will perform many quick tests encountered from day to day. It is a high speed autoranging unit, with a high contrast 3200 count liquid crystal display that includes a bargraph.

The 3060B measures AC and DC voltage up to 450V and resistance to 30M. It also incorporates a continuity check function with beeper and tests diodes and transistor junctions as well. Other features include overload protection to 450V, plus overrange and low battery indication. The 3060B is supplied with fixed test leads and a hard cover case.

For more information circle 221 on the reader service coupon or contact Obiat on (02) 698 4111. ❖



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The Gould EasyScope 340 is a portable, integrated test instrument which combines the most-needed functions of several instruments in one compact package. It features a back-lit high resolution LCD display, RS-232 plus printer interfaces. It is supplied complete with probes, protective rubber holster, rechargeable batteries and carry case.

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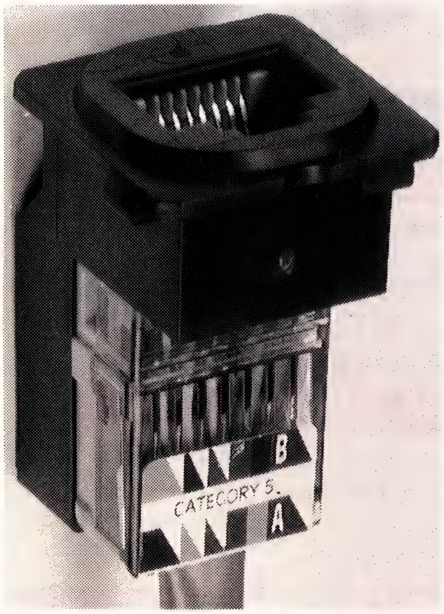
NEW PRODUCTS

Category five modular jack



The 'clever jack' from Panduit is a category five jack for phone, fax and office equipment. Wire termination can be done without specialised tools, and the jack fits into both Clipsal and HPM face plates without adaptors. It fits into both standard and architrave face plates and can be mounted in all four orientations in the plate.

To terminate the jack, the outer jacket of UTP cable is stripped back, the wires are slid into the jack's termination cap and the jack and cap are clicked together. The top of the cap is clear so wiring can be seen, and the cap can be removed if necessary.

The jack is available in eight colours, is Austel approved, has cable strain relief and is UL rated.

For further information circle 270 on the reader service coupon or contact Panduit, 30-36 Kitchen Road, Dandenong 3165; phone 1800 658 280.

Colour CCD microscope

The new K and H Products SVC-228 separated-head colour CCD video camera features a 12.5mm colour CCD high resolution video camera. With optional lenses, it can give 10x, 20x and 40x magnification with greater than 450 TVL horizontal resolution.

The system comprises a main unit which houses the power supply and interface circuitry, and connects via a two-metre cable to the camera head. Also available is an adjustable stand with lamps for object illumination. Applications include assembly and inspection of mechanical parts, surface mounted and conventional PCBs, terminators and connectors.

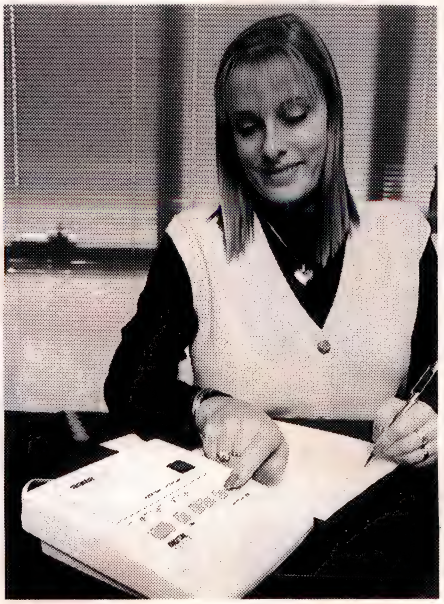
For further information circle 269 on the reader service coupon or contact Allthings Sales & Services, PO Box 25, Northlands, WA; phone (09) 349 9413.

Digital answering machine

The Shimasu digital answering machine from Dick Smith Electronics features four 'mailboxes', allowing callers to leave messages for specific members of a household or office. Each mailbox has a small red light which flashes to indicate a message has been received.

Up to four different pre-recorded messages can be stored, and being fully digital, the machine doesn't use tapes. Features include a selective save and erase, which allows individual messages to be saved or erased, and message interrupt in which the pre-recorded greeting is automatically stopped when any extension phone is lifted.

The unit also has remote operation, so recorded calls can be listened to from another phone. The time and day is automatically stamped at the end of each incoming message. The RRP is $149.



For further information contact your nearest Dick Smith Electronics store.

Compact PCB mains filter

The Belling-Lee SF3010 series PCB mounting mains filter, is a compact device designed for voltages up to 250V AC. It measures 25 x 25mm and provides a convenient solution to EMC compliance for both new and existing designers.

Available in current ratings of one, two and six amps, all three models are designed to comply with the relevant VDE, UL and CSA standards and are equipped with PCB pins for simple PCB mounting. Operating frequency is DC to 400Hz.

For further information circle 243 on the reader service card, or contact Philips Components, 34 Waterloo Road, North Ryde 2113; phone (02) 805 4479.

34MHz DDS module

The DDS4m from Novatech Instruments is a low cost, 34MHz signal source that combines small size, excellent stability, fast switching and low noise.

Packaged on a 90 x 115mm circuit board, the DDS4m simulatneously outputs a precise sinewave and an accurate TTL clock signal.

The output frequency is programmable from 1Hz up to a maximum of 34MHz in steps as small as 0.02Hz. Typical phase noise is -90dBc at 1kHz offset from carrier. The desired frequency is selected by setting a 31-bit binary number, either manually using DIP switches or remotely using HCMOS compatible parallel input lines.

For further information contact Novatech Instruments, 1530 Eastlake Ave. E., #303, Seattle, WA 98102; phone (206) 322 1562.

800W 12/24V to 240V AC inverter

The ProWatt 800i inverter from Statpower can deliver 800 watts of continuous power from any 12V or 24V DC battery. It can produce 1kW of power for five minutes, allowing it to power appliances with a high start-up demand. The inverter has a rated efficiency of 90% so very little battery energy is wasted.

An automatic shut down mode engages when the battery voltage is too high or low, or if the inverter is overheated or overloaded.

It automatically restarts once the problem has been corrected. The unit measures 76 x 229 x 254mm, and weighs 2.3kg.

For further information circle 245 on the reader service coupon or contact Statpower Australia, 77 Shore Street Cleveland 4163; phone (07) 821 3333.

68-pin PCMCIA connectors

New 68-position memory card receptacles with straddle mount and single sided surface mount configurations meeting PCMCIA and JEIDA standards are now available. An independent dual beam contact design is claimed to give extended reliability, redundant electrical contact and consistent mechanical performance. The durable contact can withstand repeated card insertions in excess of 10,000 cycles.

Materials in the receptacles are compatible with high temperature soldering processes. A flexible contact forming tool offers alternative tail configurations for custom applications.

The contact material is copper alloy and the insulator material is LCP 94 V-O rated high temperature thermoplastic. Operating temperature is -55°C to +85°C. Current rating is 0.5A DC and the dielectric strength is 500V AC for one minute.

For further information circle 246 on the reader service coupon or contact Adilam Electronics, 3 Nicole Close, North Bayswater 3153; phone (008) 800 482. ◆

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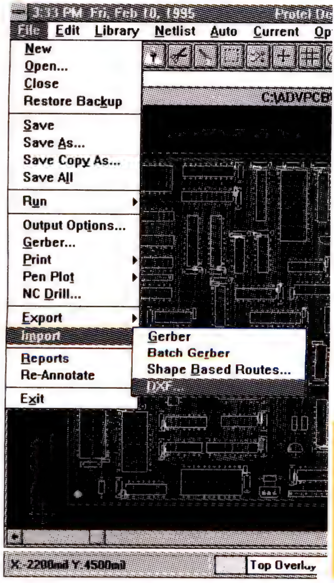

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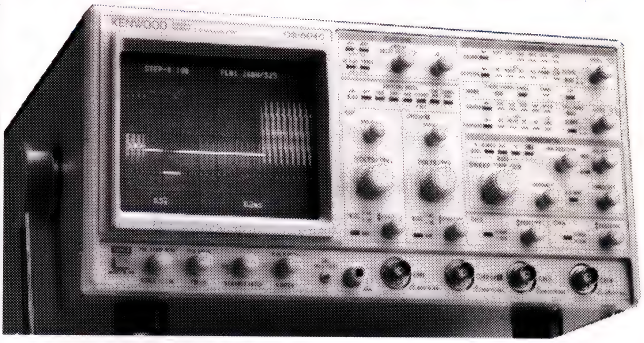

✓ 100 Programmable Steps
✓ PAL TV Line Counter

The Kenwood CS-6040 offers 150MHz, 4-channel performance with read-out and cursor measurement. It is ideal for video signal waveform observation. Programming is in 5 blocks of 20 steps for easy setting of the front panel.
The CS-6030 provides similar 100MHz performance.

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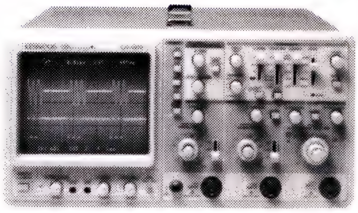

The CS-5270 offers 100MHz, 3 channel, 8 trace performance with digital read-out and cursor functions. Delayed sweep enhances observation of expanded waveforms while the video clamp eliminates triggering adjustments for TV signals etc.
Also available : CS-5275 without read-out and cursor functions, 60MHz versions CS-5260 and CS-5265 and 40MHz versions CS-5230 and CS-5235 respectively.

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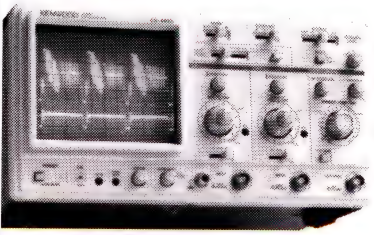

The CS-4035 is a lower cost 40MHz, 2 channel scope using the same design philosophy as Kenwood's top-of-the-line models. 1mV/div sensitivity (dc to 5MHz) is ideal for low level signals. 20ns/div fast sweep enables observation of complex waveforms. A vert. mode provides the convenience of automatically switching trigger sources.
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READER INFO NO. 26

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CONDITIONS OF ENTRY: 1. The competition is open to Australian residents authorising a new or renewed subscription to Electronics Australia before last mail on 23.01.96. Entries received after closing date will not be included. Employees of the Hannan Group, Hewlett Packard, their subsidiaries and families are not eligible to enter. 2. South Australian residents need not purchase a subscription to enter, but may enter once by submitting their name, address and phone number to: Electronics Australia/ Hewlett Packard Competition, PO Box 199, Alexandria, NSW, 2015. 3. Prizes are not transferable or exchangeable and may not be converted to cash. 4. The judge's decision is final and no correspondence will be entered into. 5. Description of the competition and instructions on how to enter form a part of the competition. 6. The competition commences 20.09.95 and closes last mail on 23.01.96. 7. The draw will take place in Sydney on 02.02.96 at 11am and the winners will be announced in a later issue of Electronics Australia and notified by mail. 8. The prize is: 2 X Hewlett Packard HP 54620A Logic Analysers, valued at $5557 each. Total prize value is $11,114. 9. Subscriptions are not refundable. 10. The promoter is the Federal Publishing Company Pty. Ltd., 180 Bourke Rd, Alexandria NSW 2015. Permit No. TC95/4138 issued under the Lotteries and Art Union Act 1901; Vic. Permit No. 95/1393 issued on 09/08/95; ACT permit no. TP95/1668 issued under the Lotteries Act 1964; NT permit no. 95/1484.

ELT/LOG/000

Solid State Update

KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

Transistor pair drives power MOSFETs

The input capacitance of power MOSFETs can range from a few hundred picofarads to tens of nanofarads and higher. To minimise the switching losses in these devices it is therefore vital that the capacitance is charged and discharged as rapidly as possible. Custom designed as power MOSFET gate drivers, a new complementary pair of medium power, high gain transistors from Zetex meets this requirement.

Since standard switching power supply control ICs are rarely able to directly drive large capacitance MOSFETs adequately, the new ZTX618 (NPN) and ZTX718 (PNP) transistor pair can act as a buffer, capable of delivering large transient charge currents quickly.

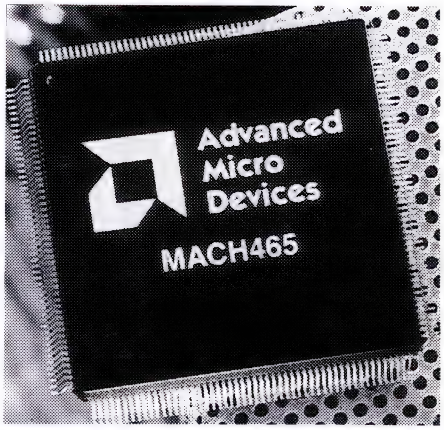
When driving a parallel pair of IRF480 power MOSFETs for example, the transistors can charge the effective input capacitance of 10nF to 12V in under 30ns.

Both devices can deliver a peak pulse current of 6A and handle continuous collector currents of 3.5 to 2.5A respectively.

For further information circle 272 on the reader service coupon or contact GEC Electronics Division, 38 South Street, Rydalmere 2116; phone (02) 638 1888.

In-circuit programmable CPLD

Advanced Micro Devices has introduced the MACH465-12, claimed to be the most feature rich 256 macrocell CPLD in the industry. The IC features 10,000 gates, 256 macrocells, 384 flipflops and can operate at speeds as fast as 12ns. It has 146 inputs, 128 of which have dedicated input registers, and operates at a maximum system frequency of 83.3MHz. Its 128 I/Os allow very high bus width or high gate count designs to be integrated into a single device. Each of the 256 macrocells provides capacity of up to 20 product terms and includes XOR logic. JTAG and 5V in-circuit programming capabilites are also included.



The CPLD consists of 16 34V16 PAL blocks interconnected by a programmable central switch matrix connecting the PAL blocks to each other, and to all input pins. An input switch matrix provides input signals with alternative paths into the central switch matrix and the output switch matix provides flexibility in assigning macrocells to I/O pins. The device is targeted at a broad range of applications including complex state machines, wide counters, memory controllers, DRAM/cache controllers, comparators, and for multiple PAL

DSP development system

Analog Devices' new ADSP-2100 family EZ-KIT Lite development system addresses the need for a full featured, low cost DSP design tool. This all inclusive kit lets designers evaluate, develop, debug and prototype a DSP application.

The development system includes a development board with 16-bit stereo audio I/O capability, assembler, linker and simulation software, PC host software, DSP algorithm source code and accessories.

Preprogrammed demonstration programs, including MPEG audio decode and echo cancellation, highlight the performance of the ADSP-2100 architecture

The kit is shipped with an on-board EPROM containing a monitor program which allows users to run demonstrations and upload/download programs from a PC.

The instruction level simulator included in the kit lets users inspect all ADSP-2181 operations on a cycle-by-cycle basis. A user configurable windowed interface provides visibility into all registers in memory. With the simulator, users can also set breakpoints, single step, and perform functions such as plotting data memory.

For further information circle 271 on the reader service coupon or contact Analog Devices, 4/1621 Point Nepean Road, (P.O. Box 98) West Rosebank 3940; phone (059) 86 7755.

replacements.

For further information circle 273 on the reader service coupon or contact VSI Electronics, 6-8 Lyon Park Road, North Ryde 2113; phone (02) 878 1299.

Isolated amp has instrumentation inputs

Burr-Brown's new ISO213 is a low power two port isolated amplifier with instrumentation amplifier inputs. Intended for applications incorporating small signals and galvanic isolation, the IC is designed for use in industrial process control, data acquisition systems, and multiplexed systems with channel to channel isolation.

The device has a low 45mW power requirement, is rated for continuous operation at 1500V RMS or 2500V RMS pulse, and offers non-linearity performance compatible with 12-bit systems (0.025%). Specifications include +/-10V input signal range, +/-40V input overvoltage protection, gain range of 0.5 to 5000 and 12V to 15V single supply operation. It is available in a low profile 38-pin ZIP package, and is priced at $29.65 in 100's.

Fur further information circle 280 on the reader service coupon or contact Kenelec, 2 Apolo Court, Blackburn 3130; phone (008) 335 245.

Power factor controller IC

GEC Plessey has announced the release of the MSC60028 power factor controller IC. This device allows the construction of high performance, low cost, off line regulators with the advantage of a near unity power factor across a wide range of load conditions.

The CMOS controller IC features a regulated boost converter voltage up to 390V DC +/-5%, trimmed internal reference, overvoltage sensing and an uncommitted op-amp.

The current mode boost circuit produces DC voltages in excess of the input line voltage, allowing operation across a wide range of line voltages, typically 80V to 270V 50Hz/60Hz without selector switches.

The device has comprehensive protection circuitry to ensure reliable operation and to extend the life of external components. During power up, the supply voltage is monitored to ensure that all circuit elements are operational before enabling the gate driver stage. Similarly, during power down (or if any unacceptably large glitch or sag occurs on the line voltage) the output stage is turned off.

To prevent voltage runaway, a high speed comparator continuously monitors the output voltage and shuts down the gate driver stage, should its value rise 6% above nominal.

When used in fluorescent light ballasts, this system brings about flicker free operation, and a reduction in bulk and an increase in lamp efficiency.

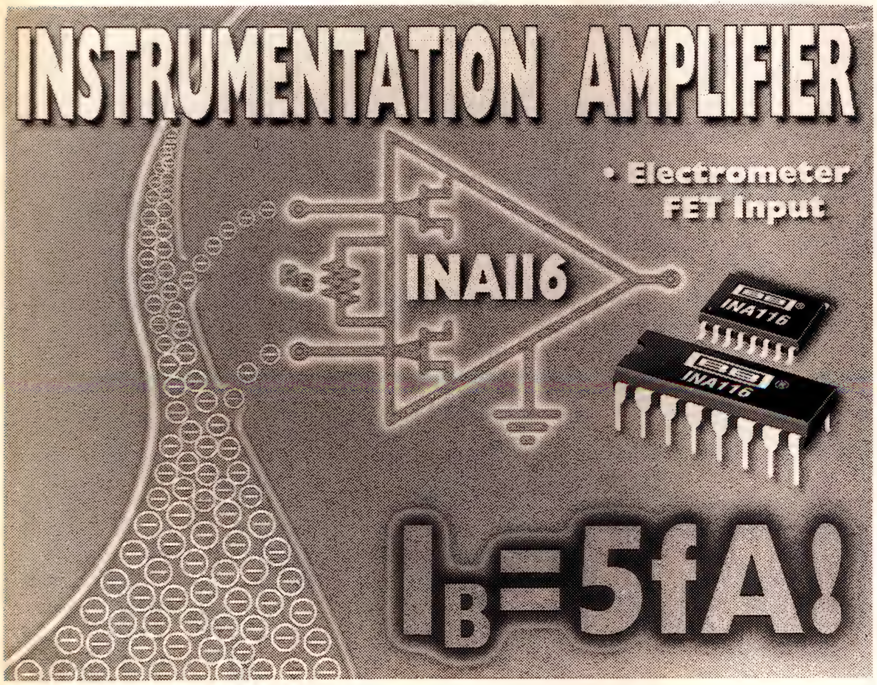
For further information circle 177 on the reader service coupon or contact GEC Electronics Division, 38 South Street, Rydalmere 2116; phone (02) 638 1888. ❖

Instrumentation amp has 5fA bias current

The INA116 from Burr-Brown is a complete monlithic FET-input instrumentation amplifier claimed as the first to offer a 5fA (typ) input bias current. Its three op-amp design provides an ultra-high impedance differential input, and allows gain setting from one to 1000 by connecting a single external resistor. The device is ideal for amplifying ion-specific probes such as pH, electric field and leakage current instruments, and other ultra low current measurements.

The IC's buffered guard connections adjacent to each input terminal make it easy to achieve ultra low leakage on a circuit board, even with the surface mount version. It operates from +/-4.5V to +/-18V and the quiescent current is 1mA. The input bias current remains low, even at high temperatures (25fA typ at 85°C), and production testing assures under 25fA at 25°C. Other specifications include: 2mV max offset voltage, 84dB (G=10) -40°C to +85°C temperature range.

For further information circle 275 on the reader service coupon or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone (008) 335 245.



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READER INFO NO. 27

SPECTRUM

Communications News & Comment

Conducted by
Tom Moffat

An interesting station, and a new Nagra

Doesn't anyone out there want any free publicity? Here we are with two Spectrum columns already on the streets, and no radio manufacturers, importers, or suppliers have taken up our offer to tell *EA* readers about news of their operations. We got a bit of stuff from two sources to kick off the first columns, but after that, nothing. So, unless there's a big change of heart out there, this could be the last Spectrum column, in this form at least.

Now, a word about some big changes to Tom Moffat Inc. By the time you read this, I should be living in the USA for several months. I will most likely be resident in Port Townsend, Washington — less than two hours driving time from Seattle. Among other things, I will be acting as kind of a foreign correspondent for *Electronics Australia.*

Seattle is becoming one of those 'where it's all happening' kind of places, what with Microsoft and Boeing and many other interesting companies headquartered there. Younger readers would know that Seattle is trying hard to displace Nashville as the music capital of the USA, and I'll be keeping an eye on that aspect of it too.

Port Townsend is on a lovely peninsula surrounded by the sea, and with enormous snow-covered mountains back behind the town. If you watch the TV program *Northern Exposure,* which is filmed nearby, you'll get the idea. PT (as we locals call it) is a town of Victorian character, with lots of holiday homes as well as permanent residences. It's the playground of Seattle.

As well as my writing, I am taking my 'High-Tech Tasmania' kit-supply business with me, with a distinct possibility of bringing in some investors and making it a much bigger operation than it is now. I am undecided whether to appoint an agent in Tasmania or to run the whole shebang myself, from Port Townsend.

As I write this I have no idea what my address will be, but I am arranging to set up strong communications links with *Electronics Australia* via phone, fax, e-mail, and snail- mail. So for now, it's best to write to me c/o *EA,* and they can forward things like submissions for the Spectrum column (hint, hint) when they ship off those handy monthly cheques to Port Townsend.

Viva Radio Marti

Now down to Spectrum business. I said that we were going to look at interesting broadcast stations from time to time, so here comes another one: Radio Marti. I discovered Radio Marti while prowling around the low frequency bands, listening for some of those weird American broadcasters like WWCR mentioned in the first Spectrum column.

In the midst of all the religious programming I stumbled on this flood of red-hot Salsa music. Salsa is all drums and brass and Spanish lyrics, and it's even becoming known in Australia via various 'world music' radio and TV programs. Salsa is also the native music of Cuba, and Radio Marti gives the Cubans a pretty good dose of it interspersed with its 'official' content.

Radio Marti is actually an arm of the Voice of America. It went on the air May 20, 1985, from studios in Washington, DC. According to the VOA, 'the broadcast marked a three-year, bipartisan effort to provide the Cuban people news, commentary and other information about events in Cuba and elsewhere to promote the cause of freedom in Cuba'.

Rick Seifert, the technical ops man at Radio Marti, told me in an e-mail message that *Radio Marti is on the air seven days a week, 24 hours a day on medium (AM) and short wave. The broadcasts include news, music, and a vareity of feature and news analysis programs. The program you heard, 'Lo Mejor de La Salsa' (the best of Salsa) is an example of a music program.*

Audience reaction, including interviews with Cuban visitors to the United States, indicates that Radio Marti is widely listened to, enjoying an audience of over 50% of the population and is considered the most popular in the island, despite Cuban government attempts to discourage listening and despite jamming of Radio Marti's medium wave broadcasts in the Havana area.

The VOA is obviously running Radio Marti for reasons other than stirring up the hot-blooded Cubans with Salsa music. As the VOA says, 'Human rights and democracy-building principles are now priorities in the programming'. Some of Radio Marti's programming includes round table discussions, testimonies from former political prisoners, recent arrivals and human rights activists, in-depth 'focus' shows on current events, a women's program, programs targeted to youth and labor sectors, and discussions on literature and the arts.

My own further listening to Radio Marti revealed lots of spoken content, but it's easy enough to ignore that and concentrate on the great music. In fact you have no option but to ignore the waffle, if you don't speak Spanish...

As for the technical aspects of Radio Marti, let's turn it over to Rick Seifert again: *At Marathon Key, Florida, facilities include a 50kW transmitter operation on 1180kHz (medium wave). The broadcast signal is fed by satellite from Washington to Marathon. This facility also has 100kW capability which is used in crisis situations.*

We often receive reception reports from your part of the world (Australia). Radio Marti also broadcasts on shortwave. Shortwave transmissions originate from both of VOA's domestic sites, Greenville, Ohio and Delano, California. Transmitter power is 250kW on all frequencies, using both high gain curtain arrays as well as dipoles.

Rick Seifert said Radio Marti would be pleased to provide frequency and program guides to listeners in Australasia (attention mis amigos from places like Chile: you'll love this!). Write to Voice of America, 400 6th Street S.W., Washington, D.C. 20547, USA.

Still within the low shortwave bands: You may remember an item in Moffat's Madhouse (December 1993) about a radio preacher named Dr Scott who was able to suck in donations to the tune of three million dollars in one evening, in $10,000 lots. And we also mentioned the 'religious' station WWCR (as in World Wide Christian Radio).

I have learned through rather nefarious means that Dr Scott and WWCR are all part of the same thing. In fact it appears that WWCR has a whole network of shortwave transmitters running mostly fundamentalist religious stuff, but it also sells out blocks of time for right-wing talkback radio shows (Radio Free America) and groups like the International Tesla Society.

Most of these transmitters seem to be operating on fairly low frequencies such as the 5MHz band, which implies that they are going for a coverage area within a couple of thousand kilometres of their antennas. The majority of these stations seem to be in the south-eastern USA. A couple of thousand kilometres east would put their signals right in the middle of the Atlantic ocean. South would produce more water, and parts of Latin America, But west and north would dump their signals right into the good ol' USA.

Now under American law, shortwave stations are supposed to broadcast only to overseas listeners, not domestic listeners. But I can tell you from experience that WWCR and its colleagues put lovely signals into Middle America, even to my little Sony portable receiver with its small whip antenna. Perhaps this is helped along by the half-million watt transmitters being used. And they certainly come rollicking in to Australia.

So are these stations flagrantly violating the law? I'm not saying it's a bad thing, because they do broadcast a point of view seldom heard on mainstream stations, and freedom of speech is very important in the USA. It will be interesting to see how much longer the FCC will tolerate these stations. I'll be keeping an ear on them, and will report further developments.

PCMCIA recorder

Now let's talk about tape recorders. Broadcast tape recorders. During the years I worked in radio and television, there was only one recorder considered truly professional, and that was an enormous 'portable' beast called a Nagra. 'Real reporters', particularly those from the ABC, carried these on shoulder straps everywhere they went, and they all seemed to walk with a list. Part of the weight was the battery of something like 12 D-cells, needed to power the Nagra for a few short hours.

In the midst of a demonstration, when protesters were intent on dismembering the fascist reactionary media, it was sometimes necessary to run carrying a Nagra. But if things really got nasty you could turn around and belt your assailant with your Nagra, instantly immobilizing him. They were tough machines.

The Nagra was used a lot for film making too, in 'double system' work where the vision was recorded on film and the sound was recorded separately on tape. To achieve 'lip sync' the Nagra and the camera exchanged sync pulses along a cable connecting them. A more advanced system used crystal oscillators on both the camera and recorder to ensure they were both running at the same speed, with no physical connection required.

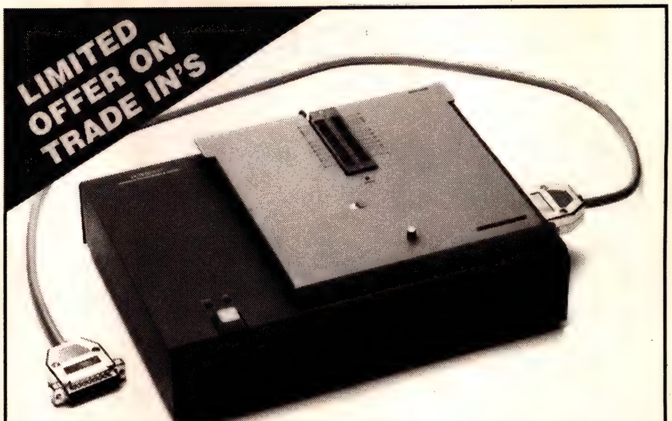
Every 'take' with double system required someone to hold a 'clapper board' in front of the camera and yell 'take one' or whatever. The sound of the snapping clapper could then be synchronized with the vision of the clapper slamming closed. Before the days of video, television and many feature films simply couldn't have been made without the use of Nagra tape recorders.

Now, for radio reporters at least, there is some relief. Nagra has now developed a tiny recorder that doesn't use tape at all; instead it uses PCMCIA memory cards (these were discussed in *Electronics Australia*, July 1995). Running from attackers with such a recorder would be a piece of cake, although whacking someone over the head with it wouldn't produce much of a result.

The new Nagra is claimed to record two hours of speech-quality audio on a 64-megabyte PCMCIA card. Trouble is, 64MB cards are few and far between and very expensive (kilobucks) — although, like all new things electronic, they will come down. But as a former radio journalist, I wouldn't be too fussed about two hours' recording time.

Anything you get to air will most likely be the standard 'thirty second grab'. A one-megabyte PCMCIA card as pictured in the July article should hold 1.8 minutes of audio, which should be plenty for two or three quick grabs in the middle of a demo or a politician's 'doorstop' interview. Just imagine a politician waffling uninterrupted for 1.8 minutes. It's a long time indeed!

I wonder how long it will be before we see one of these solid- state Nagras actually used in anger. It looks like the thing won't leave much change out of $15,000 in Australia, where the standard for radio journalists of late seems to have become the $800 Sony broadcast portable cassette recorder. The Sony is certainly not pocket sized, but you can run with it. Their audio is broadcast quality when used with an appropriate microphone, and they seem to go forever on a set of four C-cells. Nagra's going to have a battle knocking them off. ❖



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READER INFO NO. 29

PC diagnostic card review:

'Discovery Card' resolves IRQ and DMA conflicts

Designed to monitor both system interrupt and direct memory access requests at a PC's expansion slot, Allmicro's Discovery Card shows you what request lines are *actually* in use, at a hardware level. As it provides such an absolute indication of IRQ and DMA activity — unlike diagnostic software — it would be ideal for those involved in upgrading or troubleshooting PCs.

by ROB EVANS

If you've ever installed, or attempted to install a new peripheral in your IBM-compatible PC, such as a sound card, additional comms port adaptor, fax modem card and so on, you will have no doubt run into the concept of *interrupt request* (IRQ) assignments, and possibly also *direct memory access* (DMA) functions. Depending upon how smoothly your installation job went, DMA and IRQ assignments may have been anything from just a reference that you happened to notice in the peripheral card's manual, to the cause of an extended and frustrating battle between yourself and the PC.

The reason behind this potential source of trouble, in a nutshell, is that of IRQ assignment and DMA channel 'conflict', where more than one device attempts to use the same IRQ or DMA control line — there are several available in the PC, by the way.

If you are attempting to install a network card that is configured to use IRQ line number four (IRQ4) for example, this is likely to clash with your primary serial communications port (COM1) which is itself normally assigned to IRQ4. Unless you realise that a conflict exists and configure the network card to use a different interrupt line, you'll invariably end up with a system that may lock up periodically, or simply refuse to even function.

On the other hand, the network card in the above example may have its jumpers (or firmware) set to make use of say IRQ7, which is not normally used in basic PC operations. In this case the installation job will probably proceed without a hitch and you won't even be aware of the problems associated with IRQ/DMA conflicts, let alone feel like throwing the PC through the nearest window...

So until the proposed 'Plug and Play' standard has been widely accepted — where peripherals and PC hardware interconnect in a fully defined and trouble-free fashion — we're pretty well stuck with these potential conflict problems when installing PC cards and peripherals. For those that aren't familiar with IRQ assignments and DMA channels, and why they are needed in the PC's architecture, a short and general explanation may be in order.

About IRQ...

As the name implies, interrupts are used in a PC to gain the attention of the central processing unit (CPU) when a device (a peripheral or whatever) needs servicing. When you press a button on the keyboard for example, the CPU will be *interrupted* by IRQ1 — the one normally assigned to the keyboard interface — indicating that there is information from the keyboard that needs to be processed. The CPU will then effectively stop what it's doing, deal with the incoming data accordingly, then return to where it left off.

The alternative method for detecting keyboard activity would be to interrogate or check its interface at regular intervals via a program loop, with the CPU performing its normal functions between these events. However, this *polling* method of servicing peripheral events is very inefficient in terms of CPU processing time, since in this case, the keyboard will be inactive for relatively long periods (in CPU terms) and most of the cyclic checks are nonproductive.

In effect then, a significant number of CPU instruction cycles are wasted with the polling method, and the overall speed of the system is consequently reduced. With the interrupt-driven method on the other hand, the CPU only responds to the peripheral in an efficient 'on demand' manner.

IBM compatible PCs have eight basic interrupts (numbered zero to seven), with IRQ2 to IRQ7 available on the expansion bus — as IRQ0 and IRQ1 service the clock/timer and keyboard respectively, they are confined to the PC's motherboard.

An additional interrupt controller chip is included in AT-class machines (80286 and better), and this channels a further set of eight interrupts into the system via IRQ2. The AT's enhanced expansion bus then offers IRQ3 to 7 plus IRQ8 to 15, with IRQ0, 1, 2 and 8 (the AT real time clock) hardwired on the PC's motherboard.

...and DMA

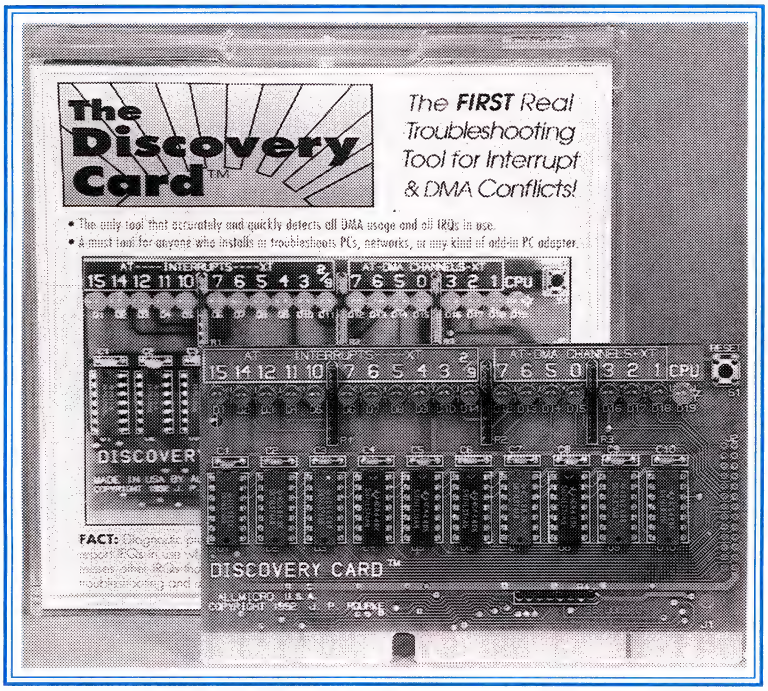
Peripherals attached to the PC's expansion bus use DMA channels to instigate a *direct* access to system memory (as the name implies), as opposed to a data transfer under CPU control using normal programmed input/output (I/O) functions. In operation, the peripheral device sends a DMA request to the DMA controller — a dedicated 'data moving' processor — which then temporarily disconnects the CPU from the system bus, and takes control over the data transfer between memory and the peripheral.

Conceived to speed up I/O data transfer in the original 8088-based PC, which had a CPU clock speed of just 4.77MHz, DMA increased the efficiency of peripherals that moved large amounts of data to and from memory, such as floppy and hard disk drives. Despite being restricted to 4MHz operation (the nominal speed in a standard ISA-bus machine) the DMA controller could move I/O data much faster than the 8088

CPU could manage at 4.77MHz. As you would expect then, today's machines operating at 33MHz or more don't suffer from this restriction, and peripheral cards using DMA have become less common. With the recent advent of much faster I/O bus systems (MCA, EISA, PCI, etc) which don't restrict the DMA controller speed though, there appears a resurgence in peripherals using this type of data transfer.

The basic XT/PC-compatible machine has four DMA channels, with DMA1 to DMA3 available on the expansion bus and DMA0 confined to the motherboard, where it controls the memory refresh function for the system's dynamic RAM. As was the case with interrupt controllers, the AT-class machines include an additional DMA controller that allows a further three channels of DMA to be accessed via one channel (DMA4). DMA0 is no longer used for the DRAM refresh function, hence DMA0 to 3 and DMA5 to 7 are all available on the I/O bus.

So as you can see from the basic concept of both IRQ assignments and DMA channels, any kind of conflict introduced by I/O devices attempting to use the same assignment/channel will tend to have catastrophic results. And while it's generally quite easy to change the IRQ/DMA configuration of one peripheral device to avoid the clash, the *real* trick is in finding out which IRQ/DMA lines are under the control of what I/O devices, and therefore where the conflict may be occurring...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7 6 5 0 3 2 1 CPU
RESET
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The diagnosis

As interrupt requests and in particular direct memory access are primarily hardware-based operations, diagnostic *software* tends to have difficulty in reporting their activity with any accuracy. This is quite easy to observe if you have several diagnostic programs at hand; just note how each reports the IRQ assignments and DMA channels used on your PC.

If the programs give a full account of the IRQ/DMA status — and perhaps wisely, many don't even bother — chances are the reports will differ widely, and don't actually match the true IRQ assignments and DMA channel use. In fact some take the rather unhelpful approach of just reporting standard or typical assignments, presumably with the idea in mind that this will be true for most systems. Perhaps they haven't considered the very active roll played by Murphy, in PC upgrades and troubleshooting...

As you've no doubt gathered then, a *hardware* based testing procedure is the only really sure-fire way to determine how a system is configured in IRQ/DMA terms, and Allmicro's Discovery Card is a prime example of this approach.

Measuring just 80mm x 137mm, the Discovery Card is designed to fit into both the 8-bit ISA (Industry Standard Architecture) I/O slot found in XT/PC-class PCs and the full-length 16-bit ISA bus connector of AT-class machines. To indicate IRQ and DMA activity it has 19 LED indicators arranged along the top edge of the card, with a red LED assigned to each control line — 11 interrupts and seven DMA channels — plus one green LED to indicate CPU 'activity'.

The only other components on the card are 10 ICs used to drive the LEDs, a small reset button, and a assortment of support components.

Considering the troublesome and potentially confusing nature of IRQ and DMA activity in a PC, the operation of the Discovery Card is deceptively simple and effective. When installed in the PC's I/O slot, the card simply monitors the IRQ and DMA lines at the expansion bus connector and latches the appropriate LED in response to any activity. If the floppy disk controller pulses the IRQ6 line for example, the 'IRQ6' LED illuminates and stays on until the card's reset button is pressed.

As the LEDs are latched on in response to even brief activity at their matching control line, you can be confident that the card has detected the true state of the IRQ and DMA lines at the I/O slot.

This in turn means that you can easily establish which IRQ and DMA lines (if any) are used by the various peripherals, and therefore quickly locate and resolve conflicts between devices.

Trying it out

Since the Discovery Card's circuit is

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Z-World's Micro Genius™ is an extremely compact and powerful miniature controller. At 80mm x 50mm it is slightly smaller than a **credit card**. Its small size, low cost and versatility make it ideal for a wide range of embedded control applications. The Micro Geniusis is configured with 14 digital I/O, 1 analog input, RS232 and RS485 comms, real time clock and watchdog. Programming is easy with Z-World's Dynamic C development environment including a powerful editor, compiler, debugger to quickly write your applications. Prices start at $149.00.

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PC Diagnostic Card

effectively made up of 18 latching logic probes which have been hardwired to the I/O connector's IRQ/DMA lines, there was really not much to check out in the pure hardware sense. When plugged in to a spare I/O slot, the card simply detected IRQ/ DMA bus activity and illuminated the appropriate LEDs, just as expected.

And while that in itself was quite educational regarding which control lines were actually used by the PC, what we really needed was a typical example of a PC in 'conflict', so to speak. This came in the form of a timeworn '286 AT-class machine that had been steadfastly refusing to acknowledge a recently-installed serial port adaptor card, which was intended to enhance the machine by providing an additional *secondary* communications port (COM2).

We had already established that the two ports were at the correct I/O addresses — 3F8h for COM1 (built into the motherboard) and 2F8h for COM2 — thanks to our diagnostic software, and knew that the serial card would work in a machine that did not have an existing port. Clearly there was some kind of incompatibility between the new card and the '286 machine, or between the two comm port adaptors.

Needless to say, the Discovery Card solved our problem in short order. When fitted to the PC's I/O slot along with the troublesome serial port card, it indicated that *both* adaptors were attempting to use IRQ4 — the interrupt request normally assigned to COM 1. Presumably, the serial card had been inadvertently set to use IRQ4 rather than IRQ3 at some stage, despite the fact that it had been configured to the normal COM2 I/O address of 2F8h.

Once we had found the card's appropriate jumper connections — the Discovery Card helped here, too — and changed the settings to IRQ3, the machine was under way with two fully-functional serial ports.

The exercise gave a fairly clear indication of the practical value of the Discovery Card, and we have no doubt that it would be just as helpful in a whole range of other troubleshooting situations. In these days of multimedia upgrades, where CD-ROM drives, soundcards and fax/modem cards use a variety of IRQ assignments and DMA channels, the potential for conflicts between peripherals is very high.

On the strength of that then, it would seem that we should all have a diagnostic tool like the Discovery Card on hand, before attempting any kind of PC upgrade. However at a tax-inclusive price of $454 (or $385 before tax) for the card, we would imagine that the investment could probably only be justified by larger corporations or those involved in professional PC support and repair.

The Discovery Card package comes with an excellent little 50-page user manual, which as well as telling you how to install and use the card, also offers a wealth of general information on the PC's IRQ and DMA functions. Written in a quite down-to-earth (although perhaps overly familiar) way, the manual covers how IRQs and DMA are used in the PC, how they operate at a circuit level, and provides a very helpful IRQ/DMA troubleshooting guide which includes a number of examples and typical scenarios.

Allmicro's Discovery Card is distributed by Interworld Electronics & Computer Industries, which stocks an extensive range of both hardware and software products for diagnosing and troubleshooting PCs. They can be contacted at 1000 Glenhuntly Road, Caufield South, Victoria 3162; call (03) 9563 5011 or fax (03) 9563 5033. ❖

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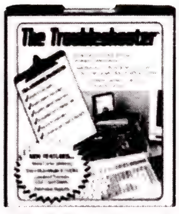

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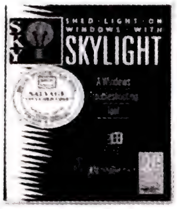

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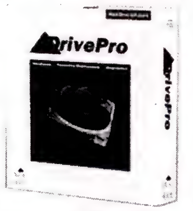

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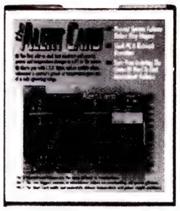

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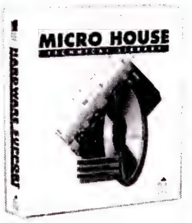

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Silicon Valley NEWSLETTER

'PCs more popular than TVs in 2000'

If Intel chief Andy Grove's prediction proves correct, the personal computer will become a major competitor to the TV receiver by the turn of the century.

Such a development would be remarkable, particularly in the United States where obsession with television has left much of the population spending an average of four hours a day passively staring at their tube. But with personal computers becoming multimedia oriented and offering the seemingly irresistible capability of interactivity, millions are turning to this 'intelligent' medium for hobby, business necessity, and entertainment.

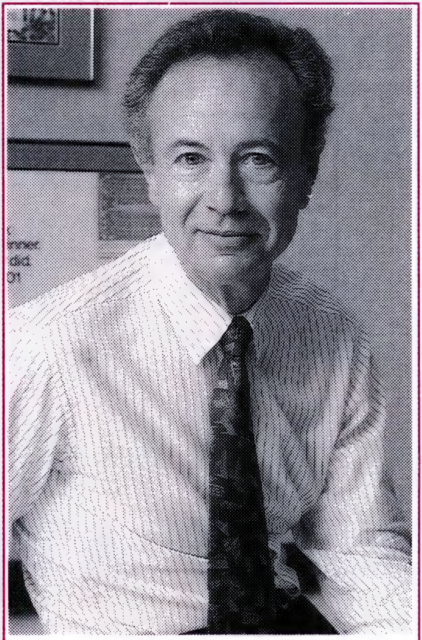
Grove recently told a group of cable industry executives that the time people spend in front of a personal computer will exceed the time they spend before the TV set by the end of the decade.

That was not exactly what the cable operators were hoping to hear, but it did fall in line with the 'Wake up and Smell the Competition' theme of this year's annual conference of the Cable Television Administration & Marketing Society, in San Francisco.

Grove said the cable industry should think of the personal computer not as a threat, but as an opportunity to expand their business. If the cable industry ignores the personal computer's penetration of homes, he said, the industry might go the way of the railroad barons who resisted investing in the automotive industry because they believed they were in the railroad business, not the transportation business.

"You're in the business of bringing programming to display tubes over a large distance", he said. "We just bring more display tubes to you. We are an opportunity. If you don't, somebody else will look at us in that fashion."

Grove demonstrated the progress the PC has made toward TV-like features such as sound, video and networked communications. The PC, he said, has become a platform for digital special effects in competition with workstation makers like Silicon Graphics. He also showed off Intel's CablePort, a product that could cement an alliance between cable providers and PC makers. as CablePort modems allow cable signals to be piped directly into PCs at high speeds, allowing interactive programming and fast Internet access.



Andrew Grove, president and CEO of Intel, who predicts that personal computers will become more popular than TV receivers by the year 2000.

Frank Biondi, chief executive officer of Viacom, one of America's largest cable TV companies, was skeptical of Grove's claim that people would spend more time with PCs than with TVs. Instead, he said that television is the avenue for passive entertainment and escapism, while the PC is much more interactive and more sophisticated.

Fujitsu spending $1B on Oregon chip plant

Fujitsu Microelectronics, a wholly owned US subsidiary of Japan's Fujitsu, has announced a US$1 billion expansion of its 200-acre Gresham semiconductor manufacturing division in Multnomah County, Oregon.

The new state-of-the-art wafer fabrication facility will process wafers in its sub-class-1 'super-clean' clean room, with less than one particle per cubic foot of air. The new facility will feature increased automation and process 8-inch wafers by using 0.32-micron process technology.

The 8-inch wafers offer double the current capacity of the 6-inch wafers that have been produced at the facility. Initially, the plant will produce 16-megabit DRAMs and will have the capability to produce 64Mb DRAMs in the future.

The investment of US$1 billion will be made in two phases, from the second half of 1995 through the second half of 1998. An additional 545,000-square-foot facility will be added to the current 225,000-square-foot plant.

The 6-inch side of the plant currently operates at full capacity, 24 hours a day, seven days a week.

TI reveals SDRAM, 'sells out' of DRAMs

Shares of Texas Instruments skyrocketed after the company announced the development of a new class of memory chip which will maximize performance of a broad variety of machines, including PCs, workstations, and TV set-top boxes. TI also said it was currently completely sold out of DRAM capacity, and expects the chip market to balloon to more than US$300 billion by the year 2000.

The new memories, known as SDRAMs, for 'synchronous dynamic random access memory', automatically synchronise their speed with the operating speed of the microprocessor at the heart of the system. TI said the first of the SDRAMs will be of a 16-megabit variety.

"Currently, there is a gap between CPU and DRAM speed performance which either complicates the system design or slows the system operation" said Bob England, senior vice president, TI Semiconductor Group. “By synchronizing to the CPU, SDRAMs optimise performance by offering as much as four times the memory performance of standard DRAMs.”

Meanwhile TI senior vice president for semiconductors, Kevin McGarity, said his company is ‘sold out’ of computer memory chips, and he does not expect the tight market to loosen until sometime in 1996.

A number of factors have contributed to the current shortage of DRAMs, McGarity said. The huge demand for memory chips has been fueled by personal computer sales, coupled with the fact that the amount of memory inside each PC is doubling.

Also, many computer makers are stocking up on memory chips in preparation for the upcoming Windows 95 operating system. Finally many key PC applications require greater amounts of memory.

Another TI executive, Vladi Catto, chief economist at the Texas chip maker, said that TI now expects the worldwide semiconductor market to more than triple in size in the next five years to more than US$300 billion, if present trends continue.

Catto said growth has averaged 15% for the past 15 years and at that rate, the market will reach US$275 billion over the next five years. “However, if the market were to grow at 20% annually — which is very much within the realm of possibility — it will grow to well over US$300 billion,” he said, adding that 1995 now marks the 10th consecutive year of expansion for the semiconductor industry.

H-P expands home PC business

After testing the waters for the three months, Hewlett-Packard said it is ready dive headlong into the competitive home PC market — having signed up eight more major US retail chains to sell its new line of consumer PCs. During the trial period, H-P has sold its line of home PCs through the Circuit City chain of consumer electronics retail outlets.

H-P said its home PCs will be available running Microsoft’s Windows 95. The company currently ranks as the third or fourth largest seller of business PC, but has been late in selling to consumers via retailers, where Packard Bell Electronics ranks highest.

Its slow entry into the home PC market was in part because it was too busy building a profitable core business market, and it was unsure whether it could make a unique technical contribution in home PCs.

H-P’s recent reluctance towards the home PC market is reminiscent of the Silicon Valley legend, which has it that H-P wasn’t interested in PCs for consumers in the early 1970s — causing one of its employees, Steve Wozniak to leave H-P to start Apple Computer.

CHIP FAB EQUIPMENT SHOWS 60% GROWTH

According to the Semiconductor Equipment and Materials International (SEMI), shipments of chip-making equipment in June exceeded US$1 billion in a single month for the first time, increasing 60% above June 1994 levels. June orders rose to US$1.2 billion, also rising 60% above June 1994 figures.

“Most in the capital equipment industry remain optimistic about business prospects through the end of 1995 and into 1996” said Elizabeth Schumann, market analyst for SEMI. “Continued reports of chip shortages and high DRAM prices serve to bolster this outlook.”

June 1995 bookings for ‘front-end’ production equipment continued to be strong, rising 52% above the same month in 1994, to US$838.9 million. Front end is the largest equipment category, comprising about 75% of the total.

Microsoft pays $6M to settle suit

Microsoft is donating US$6 million worth of software to California schools, as part of the settlement of a lawsuit in which the company was accused of ‘untrue and misleading advertisements’. Without admitting wrongdoing, Microsoft agreed to equip one classroom in each of California’s 1058 school districts with a full package including Word, Excel and Access programs.

The settlement stems from a complaint filed by Deputy District Attorney Robert Nichols of Marin County near San Francisco, in which Microsoft was accused of false advertising by shipping its popular Microsoft Office program in a box that showed four software programs, yet contained only three.

The box showed a drawing of Word for word processing, Excel for spreadsheets, PowerPoint for graphics and Mail for e-mail, implying all four were contained inside. Yet it only contained a licence to copy and use electronic mail — not the program itself.

Under the terms of the settlement, reached after two years of negotiations, Microsoft also agreed to a US$175,000 civil penalty. In addition, it will pay Marin County $90,000 for legal fees and investigative costs.

Last US TV maker bought by Korean firm

Less than two weeks after the last American typewriter company closed its doors, the US closed the books on what once was a major industry, television receiver manufacturing. Zenith, the last American television manufacturer announced it had agreed to be acquired by Korea’s LG Group for US$350 million. LG makes low-end consumer electronic products under the Goldstar brand.

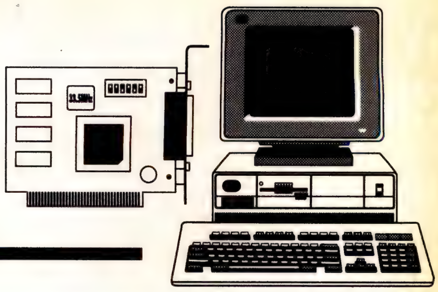
Like RCA, Sylvania and Magnavox, the Zenith TV brandname will live on, but the sets will all be made outside the United States. Since the early 1970s, Zenith defended itself against low-cost products by filing ‘anti-dumping’ complaints with the US government and moving some manufacturing operations to Mexico.

Ironically, Goldstar was one of the companies about which Zenith complained to the government for allegedly selling its sets below cost, or dumping, in the 1970s.

The company, based in Glenview, Illinois, had a long history of innovation. Among its many ingenious consumer breakthroughs, the company introduced the first TV remote control, known as ‘Space Command’, in 1956. It also set the standard for FM stereo broadcasting in the early 1960s and developed the MTS stereo sound system for TV sets in the 1980s.

However, it resisted moving into colour television until the early 1960s, preferring to hold onto its franchise in black-and-white sets. Zenith’s pioneering research on digital television has been incorporated into the efforts of a consortium that is completing the HDTV transmission standard. ❖

Computer News and New Products



Controller is programmed in C

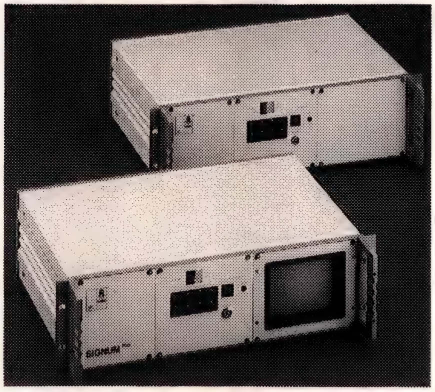
Z-World's new miniature Micro Genius is a compact and powerful C-programmable controller. At 80 x 50mm, it is slightly smaller than a credit card. The controller features 14 lines of I/O (configurable individually as inputs or outputs), an RS232 serial port, 32K SRAM, up to 512K EPROM or 256K flash EPROM, watchdog timer, power supply, and one analog input channel. An optional upgrade includes an RS485 serial port and a real time clock with scratchpad RAM.

The card can accommodate a 20,000 line C program, including multi-tasking and access to an extensive C library. Z-World's Dynamic C development system integrates an editor, compiler, and symbolic debugger. It comes with dozens of function libraries and sample programs all in source code.

Available for Windows and DOS, Dynamic C is priced at $299. The controller has an RRP of $148.

For further information circle 162 on the reader service coupon or contact Dominion Electronics, 6 - 8 Clarke Street, Crows Nest 2065; phone (02) 906 7145.

Selector for multiple PCs



Signum Plus is a monitor and keyboard selector that allows the control of up to eight PCs from a single keyboard and monitor. It is ideal for applications in PC networks and control systems and cuts down costs of up to seven keyboards and monitors, while also saving on energy, running costs and space.

A second monitor can be operated simultaneously in the system with the internal monitor, and activity on individual PCs can be monitored from a single workstation. The unit incorporates an integrated keyboard lock which protects the system against unauthorised access and the system can function as a 19" chassis or bench case .

Options include the ability to reboot all PCs at the same time, to have channel control from the PC keyboard and to position the keyboard and monitor up to 1300 metres from the PCs.

For further information circle 161 on the reader service coupon or contact Ricon, 66 - 76 Dickson Avenue, Artarmon 2064; phone (02) 439 6078.

CD-ROM simulates the Internet

The Internet for Everybody is a CD-ROM that shows you what to type and exactly how the computer screen looks and acts, when you are on the Internet. The aim is to give new Internet users confidence before logging on to the real thing.

Easy to use video titler

The Datavideo VP-271 Screen Title Producer is a microcomputer based self-contained unit which can be used to add professional titles to video programmes in any of the standard formats including VHS, VHS-C, SVHS-C, Video 8 and Hi-8. It has a title text memory of up to 10 pages, with 11 lines per page and 24 characters per line.

Character options include upper and lower case, in four sizes. Titles can appear superimposed on live video or on internally generated black or block backgrounds, and can be zoomed in or out, cut in/out, wiped in/out, scrolled up or down the screen, panned across the screen horizontally, or flashed on and off. Three speeds are available for wiping and scrolling.

Operation is simplified using on-screen menu displays. Once prepared and stored in memory, titles can be played back manually, automatically in sequence or cyclically. The VP-271 operates from a 9V plug pack (included), and has standard 75Ω video impedance levels. It has a rated video bandwidth of 5MHz for composite video and 5.5MHz for S-Video.

Priced at $399, the Datavideo VP-271 is available from Rod Irving Electronics stores as Cat. No. A12010.

The CD-ROM has over two hours of live video clips, showing various methods of connecting to and using the Internet. The many and varied uses of the Internet are shown from the viewpoints of four different people: a retired chemist, a high school teacher, a consultant in Hong Kong and a teenager. The RRP of the CD-ROM disc is $89.

For further information circle 163 on the reader service coupon or contact Light Years Ahead, 23 Leighton Place, Hornsby 2077; phone (02) 477 6666.

High definition 21" monitor

Hitachi has released a new top of the line colour monitor design specifically for imaging applications. Claimed as featuring the highest specification level available, with two megapixel (1600 x 1200) defition at 85Hz, the Hitachi CM2112M offers a professional selection of colour and geometry adjustments, including moire reduction.

The new 21" model has 31 presettings and simple, on-screen menu. It also complies with the American Plug & Play specification (DDC1/2B), ensuring that essential connection data, such as display size and video timing, is automatically passed to the computer.

The non-interlaced screen has vertical refresh rates from 50 - 160Hz depending on the resolution required, and a video clock frequency of 220MHz.

Compatible with VGA, Super VGA, EVGA and XGA standards, the monitor is fully compliant with Swedish MPR-2 low radiation standards and has all current energy saving features. The RRP is $5495 including tax, and the monitor carries a three year warranty.

For further information circle 164 on the reader service coupon or contact Hitachi Australia, 73 Miller Street, North Sydney 2060; phone (02) 929 8799.

Secure private Internet exchange

XCP Security Systems has announced the availability of the Private Internet Exchange (PIX) in Australia and New Zealand.

Like a telephone exchange that serves many internal users with a few lines, the PIX serves many internal workstations requiring connection to the Internet with a unique internal IP address store, thereby providing a high level of security.

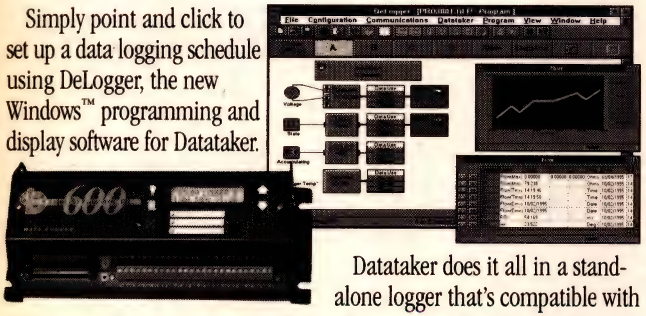
When a user wants to get onto the Internet, they are routed into the PIX which translates the internal corporate address for that workstation into one from the internal pool of the PIX, before being handed over to the Internet server. The result is that a hacker watching the corporate network traffic can never see the internal addresses. Conversely, if an external message is directed to the internal network, the incoming address is stripped off and replaced with an address from the PIX pool so again, the internal corporate address structure is not revealed to the outside world.

For further information circle 166 on the reader service card or contact XCP Security Systems, 541 Blackburn Road, Mt Waverley 3149; phone (03) 9550 0835 or XCP@ozemail.com.au.

Protel V3 Advanced Schematic

EDA software developer Protel Technology has announced what it calls the next generation of EDA tools with the release of Advanced Schematic V3. The program is a major upgrade with an array of powerful features including a completely new user interface offering a range of customisation, text editing and programming tools. User definable options include creating additional

Point-and-click data logging



Simply point and click to set up a data logging schedule using DeLogger, the new Windows™ programming and display software for Datataker.

DeLogger will not only program your logger, but give you real-time trend plots and tables.

Data logging with Datataker really is this simple.

Just connect thermocouples, RTDs, strain gauges, load, flow, level, pressure, meteorological,... in fact, any sensor you like.

No add-on cards. No signal conditioning. No complex programming.

Datataker does it all in a stand-alone logger that's compatible with all computers. Notebooks to mainframes.

Datatakers are available with one to hundreds of channels. Alarms, calculations and a full range of statistical functions are standard.

To find out how simple data logging can be, call the data acquisition experts...

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The Portable Analyser Chassis from LinearX. PAC III will accommodate up to 3 LinearX slot cards such as pcRTA, LMS, etc. A truly portable professional audio acoustic system.

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menus, commands, and toolbars to suit individual work habits, plus flexible toolbar positioning for more on-screen workspace.

A special feature is an internal text editor and V3 also provides programmable syntax highlighting which supports VHDC, Verilog and SPICE, among others. It also supports compound projects, allowing mixed PCB, schematic and text files.

Macros are a new feature for maximum user control, supporting Client Pascal, Client Basic and new API. V3 also provides third party support for EDA servers including PSpice, MSASH, HP-EEsof and Xilinx XACT5. It has e-mail facilities and 'cut and paste' to other applications as well as the best features of its predecessor, including over 16,000 component symbols in the library editor, over 35 netlist output formats and import facilities for OrCAD SDT3, 4 and 386+ sheet files and libraries.

For further information circle 168 on the reader service coupon or contact Protel Technology, GPO Box 204, Hobart 7001; phone 1800 030 949.

PowerPC motherboards

Motorola has released new high performance Ultra and Atlas motherboards, based on the PowerPC 603e microprocessor. They are available in all-in-one, low profile motherboard or standard Baby-AT form factors, respectively.

The boards support a number of popular operating environments, including IBM AIX 4.1 and Microsoft Windows NET 3.51 operating systems, and operate at up to 100MHz.

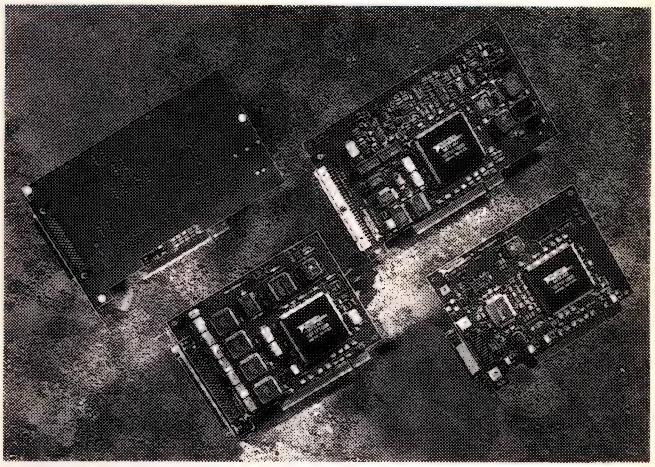
The boards offer a choice of either a 66Mhz Power PC 603 microprocessor, a 100MHz PowerPC 603e or a 100MHz PowerPC 604 micrprocessor. Other features include PCI and ISA expansion slots, an 8-bit SCSI-2 bus interface with 32-bit PCI local bus burst DMA, an Ethernet transceiver interface with 32-bit PCI local bus DMS, 10base-2 and 10base-T interfaces; NVRAM and time-of-day clock and removable battery back-up, a floppy port, IDE port, a mouse and keyboard ports.

The boards also provide two serial communication ports in addition to the IEEE 1284 ports.

The motherboards have a five year warranty on parts and labour for product shipped back to the MCG factory for repair.

For further information circle 170 on the reader service coupon or contact Motorola Computer Systems, 69 Nicholson Street, St Leonards 2065; phone (02) 906 3855. ❖

DAQ boards for Power Mac

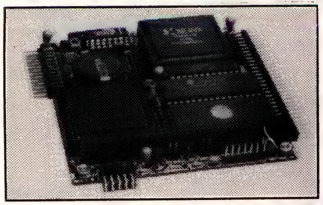


National Instruments has released its first PCI (peripheral component interconnect) GPIB instrument control and data acquisition (DAQ) boards designed for the Power Macintosh 9500. The GPIB and DAQ boards, which include NI-488.2 and NI-DAQ driver software respectively, are ideal for laboratory automation, test and measurement, and process monitoring and control applications.

The PCI-GPIB performs talker, listener, and controller functions, including those reuqired by IEEE 488.2, and implements the HS488 high speed GPIB protocol and standard IEEE 488 transfer. The PCI-MIO-16XE-50 is a high performance analog, digital and timing I/O board. It can be plugged into a Power Macintosh and completely configured through spoftware.

For further information circle 172 on the reader service coupon or contact National Instruments Australia, PO Box 466, Ringwood 3134; phone (03) 879 9422, e-mail: info.australia@natinst.com.

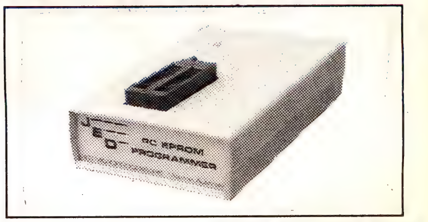
Australian Computers & Peripherals from JED... Call for data sheets.



Australia's own PC/104 computers.

The photo to the left shows the JED PC540 single board computer for embedded scientific and industrial applications. This 3.6" by 3.8" board uses Intel's 80C188EB processor. A second board, the PC541 has a V51 processor for full XT PC compatibility, with F/Disk, IDE & LPT. Each board has two serial ports (one RS485), a Xilinx gate array with lots of digital I/O, RTC, EEPROM. Program them with the $179 Pacific C. Both support ROMDOS in FLASH. **They cost $350 to $450 each.**

$125 PROM Eraser, complete with timer



$300 PC PROM Programmer.

(Sales tax exempt prices)

Need to programme PROMs from your PC?

This little box simply plugs into your PC or Laptop's parallel printer port and reads, writes and edits PROMs from 64Kb to 8Mb.
It does it quickly without needing any plug in cards.

JED Microprocessors Pty. Ltd

Office 7, 5/7 Chandler Road, Boronia, Vic., 3155. Phone: (03)9 762 3588 Fax: (03)9 762 5499

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RF Chokes

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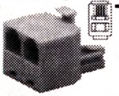
CHOKE-1.5uH	1.5 Micro Henry	1.05
CHOKE-2.2uH	2.2 Micro Henry	1.05
CHOKE-2.7uH	2.7 Micro Henry	1.05
CHOKE-3.3uH	3.3 Micro Henry	1.05
CHOKE-4.7uH	4.7 Micro Henry	1.05
CHOKE-6.8uH	6.8 Micro Henry	1.05
CHOKE-10uH	10 Micro Henry	1.05
CHOKE-15uH	15 Micro Henry	1.05
CHOKE-18uH	18 Micro Henry	1.05
CHOKE-22uH	22 Micro Henry	1.05
CHOKE-33uH	33 Micro Henry	1.05
CHOKE-47uH	47 Micro Henry	1.05
CHOKE-68uH	68 Micro Henry	1.05
CHOKE-100uH	100 Micro Henry	1.05
CHOKE-120uH	120 Micro Henry	1.05
CHOKE-180uH	180 Micro Henry	1.05
CHOKE-220uH	220 Micro Henry	1.50
CHOKE-270uH	270 Micro Henry	1.05
CHOKE-330uH	330 Micro Henry	1.05
CHOKE-470uH	470 Micro Henry	1.05
CHOKE-680uH	680 Micro Henry	1.05
CHOKE-1000uH	1000 Micro Henry	1.05
CHOKE-2200uH	2200 Micro Henry	1.05
CHOKE-3300uH	3300 Micro Henry	1.05
CHOKE-4700uH	4700 Micro Henry	1.05

Telephone Accessories



TEL-CNC6	6 x 6 US Plg to US Skts	4.05
TEL-CNC7	Inline 6 x 4 Joiner	4.00
TEL-RJ45-JOINER	RJ45 Inline Joiner	3.70
TEL-CNC8	6 x 6 US Entry Box	3.55
TEL-CNC10	6 x 6 US Entry Box	4.10
TEL-CNC11	Dual 6 x 6 US Entry	8.15
TEL-CNL9	6 x 6 Extension Cable	8.20
TEL-CNL11	5M 6 x 6 Dual Extn	9.10
TEL-CNL16	5M 6 x 6 Plg to Plg	7.20
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TEL-PT35L	RJ45 8 Way 5 Metres	6.45
TEL-PT28	RJ45 Dual Adaptor	8.25
TEL-PT44	Plug-4 Slot 4 Pin Wired	3.10
TEL-PT64	6 x 4 Modular Plug	3.25
TEL-PT66/5	6 x 6 Modular Plug	3.95
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TEL-3	Telephone Dual Adaptor	20.35
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TEL-5	2.5M Extension Cable	12.35
TEL-6	10M Extn Cable	18.40
TEL-8	Aust Plug to US Skt	7.05
TEL-9	6 x 4 Extension Cable	7.65
TEL-11	5M 6 x 4 Dual Extn	7.15
TEL-14.C	4 x 4 Curly Cord	5.50
TEL-16	5M 6 x 4 Plg to Plg	4.50
TEL-18	5M 8 x 8 Plug to Plug	6.95
TEL-21	Telephone Extn Bell	30.25

Heat Shrink

Supplied in 1metre lengths.

PHS1.5-BLK/METRE	1.5mm to 0.5mm	2.35
PHS1.5-BLU/METRE	1.5mm to 0.5mm	2.35
PHS1.5-CLR/METRE	1.5mm to 0.5mm	2.35
PHS1.5-RED/METRE	1.5mm to 0.5mm	2.35
PHS1.5-WHT/METRE	1.5mm to 0.5mm	2.35
PHS2.5-BLK/METRE	2.5mm to 1.5mm	2.40
PHS2.5-BLU/METRE	2.5mm to 1.5mm	2.40
PHS2.5-CLR/METRE	2.5mm to 1.5mm	2.40
PHS2.5-RED/METRE	2.5mm to 1.5mm	2.40
PHS2.5-WHT/METRE	2.5mm to 1.5mm	2.40
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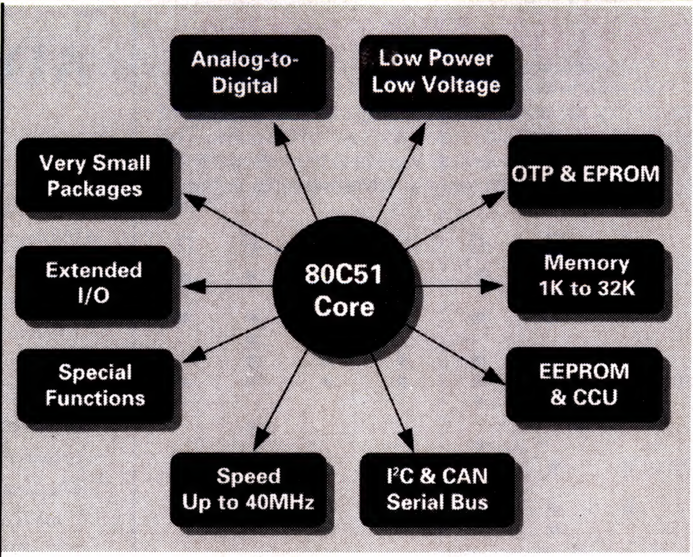
PHS3.5-RED/METRE	3.5mm to 2mm	2.95
PHS3.5-WHT/METRE	3.5mm to 2mm	2.95
PHS5-BLK/METRE	5mm to 2.9mm	3.20
PHS5-BLU/METRE	5mm to 2.9mm	3.20
PHS5-CLR/METRE	5mm to 2.9mm	3.20
PHS5-RED/METRE	5mm to 2.9mm	3.20
PHS5-WHT/METRE	5mm to 2.9mm	3.20
PHS7-BLK/METRE	10.7mm to 4.2mm	3.70
PHS7-BLU/METRE	10.7mm to 4.2mm	3.70
PHS7-CLR/METRE	10.7mm to 4.2mm	3.70
PHS7-RED/METRE	10.7mm to 4.2mm	3.70
PHS7-WHT/METRE	10.7mm to 4.7mm	3.70
PHS10-BLK/METRE	10mm to 6	4.55
PHS10-BLU/METRE	10mm to 6mm	4.55
PHS10-CLR/METRE	10mm to 6mm	4.55
PHS10-RED/METRE	10mm to 6mm	4.55
PHS10-WHT/METRE	10mm to 6mm	4.55
PHS13-BLK/METRE	13mm to 8.5mm	5.70
PHS13-BLU/METRE	13mm to 8.5mm	5.70
PHS13-CLR/METRE	13mm to 8.5mm	5.70
PHS13-RED/METRE	13mm to 8.5mm	5.70
PHS13-WHT/METRE	13mm to 8.5mm	5.70
PHS16-BLK/METRE	16mm to 11mm	5.70
PHS16-BLU/METRE	16mm to 11mm	5.70
PHS16-CLR/METRE	16mm to 11mm	5.70
PHS16-RED/METRE	16mm to 11mm	5.70
PHS16-WHT/METRE	16mm to 11mm	5.70
PHS20-BLK/METRE	20mm	8.65
PHS20-BLU/METRE	20mm	8.65
PHS20-CLR/METRE	20mm	8.65
PHS20-RED/METRE	20mm	8.65
PHS20-WHT/METRE	20mm	8.65
PHS25-BLK/METRE	25mm	11.00
PHS25-BLU/METRE	25mm	11.00
PHS25-CLR/METRE	25mm	11.00
PHS25-RED/METRE	25mm	11.00
PHS25-WHT/METRE	25mm	11.00



Ever wanted to try out the new generation of microcontrollers?

Well here's the low cost way to do it with the DS-750 Development Kit from Philips for only $159.90!!

Look at the DS-750 features –

- **Emulates 87C750 Microcontrollers in Real-Time**
- **Programmable Clock up to 40MHz**
- **Built-in Programmer for 87C750/I/2**
- **High-speed Hardware Simulator**
- **Source-Level Debugger for C, PLM and Assembler**
- **24-pin DIP Emulation Header**
- **Serially linked to IBM PC at 115 KBaud**

The Ceibo DS-750 supports 87C750 Philips microcontrollers at any frequency allowed by the devices. It is serially linked to a PC/XT/AT or compatible systems and can emulate the microcontrollers using either the built-in clock oscillator or any other clock source connected to the microcontroller.

The clock oscillator generates 40MHz, 20MHz, 16MHz, IOMHz and 5MHz. Emulation is carried out by programming an 87C752 microcontroller with the user software and an embedded monitor program. The DS-750 provides the on-board programming capabilities and locates the monitor in the upper 1K that is not available for the 87C750.

Three working modes are available: real-time, simulator and simulator plus. In the real-time mode the user software is executed transparently and without interfering with the microcontroller speed. Breakpoints can be added to stop program execution at a specific address. In the simulator modes, an additional microprocessor is used to take control of the 87C750 lines and to simulate its operation but not in real-time.

This operating mode allows access to all the microcontroller functions (I/O, timers, etc.) and interacts with the hardware according to the user software execution or directly by means of emulator commands sent from the host computer. The combination of the two available working modes allows an easy way to debug hardware and software functions. The software includes C, PLM and Assembler Source Level Debugger, On-line Assembler and Disassembler, Software Trace, Conditional Breakpoints and many other features.

APPLICATIONS

The main applications of the DS-750 Kit are: -

Evaluation of Philips microcontrollers
Demonstration of microcontroller capabilities
Development of microprocessor based systems
Hardware and software debugging purposes
Training in the field of microprocessors
Programming of Philips microcontrollers

EXPERIMENTS

Five experiments demonstrate the capabilities and advantages of the 80C51 device and its derivatives. Completing each of the experiments will provide the user with more knowledge and experience.

1: Getting to know the DS-750

This experiment carries out several exercises to describe the functions of DS-750.

2: Data Transfer Instructions

This experiment helps you to understand the different addressing modes of the devices, writing programs that use the data transfer instructions, and transfer data and code to and from different memory types.

3: Input/Output Ports

This experiment shows how to manipulate Boolean variables, use the input/output capabilities of the microcontrollers, and how to assemble programs that use the ports of a microcontroller.

4: Arithmetic& Logic Functions

This experiment will help to make calculations with the microcontroller, replace logic circuits by microcontroller functions, and to write programs that use arithmetic and logic instructions.

5: Control Transfer Operations

After completing this experiment the user should be able to understand the stack operations, write programs that use the control transfer instructions and pass control to subroutines.

The DS-750 system is supplied with a User's Manual, debugger and application software (including Cross Assembler), microcontroller documentation (huge databooks!), two samples of the 87C752 and one of the 87C750 (all windowed EPROM microcontrollers), RS-232 and interfacing cables and a power supply.

All you need to get up and running for just **$159.90**

Plug Packs

All for 240Vac operation.

PP-300MV	3/4.5/6/7.5/9/12Vdc @ 300mA	23.20
PP-500MV	3/4.5/6/7.5/9/12Vdc @ 500mA	25.55
PP-1000MV	6/7.5/9/12Vdc @ 1A	35.95
PP-9138	13.8Vdc @ 800mA	35.95
PP-09V-AC-300MA	9Vac@ 300mA	20.95
PP-10VAC-1A	10Vac @ 1A w/- 2.1mm Plug	28.60
PP-12V-AC-300MA	12Vac @ 300mA	13.95
RPP250*	Regulated 1/3/4.5V @ 250mA	30.95
RPP500*	Regulated 6/9/12V @ 500mA	40.80

** Ideal for Walkmans etc*

Hakko Irons

You won't find a better range of soldering/desoldering tools! Here's the complete list of irons, tips, spares etc!

HKO-470	Desoldering Tool	1349.30
HKO-470-SPONGE	Sponge	4.80
HKO-802-ELEMENT	802 24V/50W Heater Elmt	91.10
HKO-802-EL-COVER	Element Cover for 805	4.75
HKO-802-EL-NUT	Nut for 802 Element Cvr	6.10
HKO-802-NZL-0.8S	802 0.8mm Slim Nozzle	29.00
HKO-802-NZL-1.0S	802 1.0mm Slim Nozzle	29.00
HKO-802-NZL-0.8	802 0.8mm Nozzle	29.00
HKO-802-NZL-1.0	802 1.0mm Nozzle	29.00
HKO-802-NZL-1.3	802 1.3mm Nozzle	29.00
HKO-802-NZL-1.6	802 1.6mm Nozzle	29.00
HKO-802-PIPE-HLD	802 Filter Pipe Holder	21.10
HKO-802-FILT-SM	802 Small Ceramic Paper	13.60
HKO-802-FLTR-SPR	802 Spring Filter	20.35
HKO-802-REAR-HLD	Holder Assembly for 802	12.65
HKO-PIN-0.8	0.8mm Clng Pin 802/483	4.65
HKO-PIN-1.0	1.0mm Clng Pin 802/483	4.65
HKO-PIN-1.3	1.3mm Clng Pin 802/483	4.65
HKO-PIN-1.6	1.6mm Clng Pin 802/483	4.65
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HKO-ANTI-SEIZE	Anti Seize Compound	5.80
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HKO-481-T-0.8	481 0.8mm Tip	33.95
HKO-481-T-1.0	481 1.0mm Tip	33.95
HKO-481-T-1.3	481 1.3mm Tip	33.95
HKO-481-T-1.6	481 1.6mm Tip	34.95
HKO-481-HEATER	481 Heater	45.15
HKO-481-CORE	481 Heater Core & Cover	88.65
HKO-481-TOOL	481 Tip Removal Tool	21.20
HKO-481-FRNT-HLD	Front Holder & O Ring	24.05
HKO-481-REAR-HLD	Rear Holder with O Ring	20.15
HKO-483-HEATER	483 Heater Element	51.80
HKO-483-T-0.8	483 0.8mm Tip	36.20
HKO-483-T-0.8S	483 0.8mm Slim Tip	36.20
HKO-483-T-1.0	483 1.0mm Tip	36.20
HKO-483-T-1.0S	483 1.0mm Slim Tip	36.20
HKO-483-T-1.3	483 1.3mm Tip	36.20
HKO-483-T-1.6	483 1.6mm Tip	36.20
HKO-483-CORE	483 Heater Core & Cover	85.35
HKO-483-PIN	483 Heater Core Pin	7.45
HKO-483-TOOL	483 Tip Removal Tool	21.05
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HKO-483-FILTERS	483 Filter Set 10 Piece	31.05
HKO-483-FX-PLATE	Fixing plate 481/483	6.80
HKO-483-VALVE-PL	Valve plate 481/483	12.65
HKO-700C	Combined Station	1590.95
HKO-700C-243	PCB for Desolder Side	75.15
HKO-700-RCPTCL	Insulator for Holders	5.10
HKO-800L-HEATER	60W Heater for 700C	53.80
HKO-800L-CORE	800L Heater Core	99.70
HKO-800L-F-HOLD	Front Holder for 700C	35.10
HKO-800L-R-HOLD	Rear Holder for 700C	12.95
HKO-850	SMD Rework Station	1328.60
HKO-850-HEATER	850 Heater Element	65.00
HKO-850-HTR-PIPE	850 Heater Element Pipe	80.45
HKO-851	SMD Rework Station	896.70
HKO-808	Portable Desolderer	642.95
HKO-900L	Heavy Duty Iron	90.25
HKO-900L-HEATER	Use 900M-H	
HKO-900M	Iron with 1.6mm Tip	83.75
HKO-900M-ENCLSR	Small Tip Enclosure	4.30
HKO-900M-NUT	Small Nut	4.30
HKO-900M-NIPPLE	Small Nipple,Pipe&Fitt	8.30
HKO-900M-NUT-ENC	900M Small Enc. & Nut	8.60
HKO-900M-HEATER	Heater for 926	35.70
HKO-900M-T-LB	0.2mm Conical Tip	15.40
HKO-900M-T-B	0.5mm Conical	11.05
HKO-900M-T-K	Knife tip	23.25
HKO-900M-T-I	Tip for 900M Iron	11.05
HKO-900M-T-1.6D	1.6mm Dual Flat Tip	11.05
HKO-900M-T-1.8H	1.8mm Offset Tip	18.40
HKO-900M-T-1C	1.0mm Single Flat	15.40
HKO-900M-T-1CF	Offer 900M-T-1C	15.40
HKO-900M-T-2.4D	2.4mm Dual Flat Tip	11.05
HKO-900M-T-2C	2.0mm Single Flat	11.05
HKO-900M-T-2CF	Offer 900M-T-2C	11.05
HKO-900M-T-3.2D	3.2mm Dual Flat Tip	11.05
HKO-900M-T-3C	3.0mm Single Flat	11.05
HKO-900M-T-3CF	Offer 900M-T-3C	11.05
HKO-900M-T-4C	4.0mm Single Flat	11.05
HKO-900M-T-4CF	Offer 900M-T-4C	11.05
HKO-900M-T-R	SMD Tip	22.90
HKO-900M-T-RT	SMD Tip	22.90
HKO-900S	Small Iron for 926	90.25
HKO-900S-HEATER	Heater for 900S	40.60
HKO-900S-T-1	Tip for 900S	14.35
HKO-900S-T-1.2D	Tip for 900S Iron	14.35
HKO-900S-T-1.6D	Tip for 900S Iron	14.35
HKO-900S-T-1C	Tip for 900S Iron	18.40
HKO-900S-T-2C	Tip for 900S Iron	14.35
HKO-900S-T-B	Tip for 900S Iron	14.35
HKO-924	FP Desolderer	132.40
HKO-924-T-1002	9.5x9.5mm 924/926 Tip	29.80
HKO-924-T-1003	12.5x12.5mm 924/926 Tip	29.80
HKO-924-T-1004	13.3x13.3mm 924/926 Tip	29.80
HKO-924-T-1005	14x14mm 924/926 Tip	29.80
HKO-924-T-1006	20x14mm 924/926 Tip	29.80
HKO-924-T-1007		29.80
HKO-924-T-1010	6x5mm 924/926 Tip	29.80
HKO-924-T-1011	6x10mm 924/926 Tip	29.80
HKO-924-T-1012	7x12.5mm 924/926 Tip	29.80
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HKO-924-T-1014	9x18mm 924/926 Tip	29.80
HKO-924-T-1020	9.5mm Spatula 924/926	16.95
HKO-926	Adjustable 200C - 480C	222.60
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HKO-926-SPONGE	926 Tip Sponge	4.85
HKO-926-TERM-BLK	Terminal Block for 926	1.55
HKO-926-TIP-TRAY	Tip Tray & Sponge	7.20
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Which of our many advertisers are most likely to be able to sell you that special component, instrument, kit or tool? It's not always easy to decide, because they can't advertise all of their product lines each month. Also some are wholesalers and don't sell to the public. The table below is published as a special service to EA readers, as a guide to the main products sold by our retail advertisers. For address information see the advertisements in this or other recent issues.

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A Kits and modules
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C PC boards and supplies
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REMOTE VOLUME

Brand new high quality motor driven potentiometer, like those used in commercial stereo sound systems. Includes a clutch, so can also be manually adjusted. Standard 1/4" shaft, stereo (dual 100k pots) with 5V, 20mA motor. Special introductory price **$15**

A UHF remote control kit for this unit is now available. Add a remote controlled volume system to an old TV or stereo. The controller can also be used to drive electromechanical devices via relays. Kit includes commercial 2-ch UHF Tx, Rx module, PCB motor-driven pot *or* relays, PCB and all on-board components. **$63** for volume control **$55** for relay kit. Plugpack to suit **$12**

MORE ITEMS & KITS

Poll our **(02) 579 3955** fax number to find out how to get our item and kit lists. MANY MANY MORE ITEMS AND KITS THAN THOSE LISTED HERE! *Ask for these lists to be sent with your next order.*

KITS

SINGLE CHANNEL UHF FOR CENTRAL LOCKING
Our single channel UHF receiver kit has been updated to provide provision for central locking!! Key chain Tx has SAW resonator, see SC Dec 92. Compact receiver has pre-built UHF receiver module, and has provision for two extra relays for vehicle central locking function. Kit comes with two relays. **$36** Additional relays for central locking **$3** ea. Single channel transmitter kit **$18**

MASTHEAD AMPLIFIER SPECIAL
High perfomance low-noise masthead amplifier covers VHF-FM-UHF and is based on a MAR-6 IC. Includes two PCBs, all on-board components. For a limited time we will also include a suitable plugpack to power the amplifier from mains for a total price of: **$25**

PROTECT ANYTHING ALARM KIT EA May 93, PCB and all on-board components *ON SPECIAL* **$20**

4-CHANNEL UHF REMOTE CONTROL KIT: Two Tx & 1 Rx **$96**.

LASER BEAM COMMUNICATOR KIT: Tx, Rx, plus IR laser: **$60**

FM TRANSMITTER KIT - MK1 This complete transmitter kit (miniature microphone included) is the size of an AA battery, and is powered by a single AA battery. Use a two AA battery holder (provided) as the case, and a battery clip (shorted) for the switch. Battery life is over 500 hours!! **$11**

BRAKE LIGHT INDICATOR KIT: 60 LEDs, two PCBs and ten resistors, makes a very bright 600mm long, high intensity red display **$25**.

GARAGE DOOR - GATE REMOTE CONTROL KIT: SC 4/94 Tx **$18**, Rx **$79**.

1.5-9V CONVERTER KIT: $6 ea. or 3 for **$15**.

PLASMA BALL KIT: PCB and components kit, needs any 240V light bulb *ON SPECIAL* **$20**.

COMPONENTS

HIGH VOLTAGE DISC CERAMICS 680pF/3kV **20 for $4**, 15nF/3kV **$2**, 1nF/15kV **$4**

HIGH VOLTAGE DIODES high speed 1kV/1A **10 for $5**, 8kV/20mA **$1.50**, 16kV/20mA **$2**

TRIACS 600V/60A *CLEARANCE* **$3**

HIGH INTENSITY RED LEDS 550 - 1000mCd @ 20mA, 100mA max, 5mm: **10 for $4 or 100 for $30**

BLUE LEDs 5mm **$2.50**

ELECTRET MIC INSERTS High output omnidirectional standard size **10 for $8** also some high quality unidirectional electrets removed from new equipment **$3**

EPROMS: 27C512, 512K (64K x 8), 150ns access CMOS EPROMs. Removed from new equipment, need erasing, guaranteed, **$4**.

ULTRASONIC TRANSDUCERS High quality Murata 40kHz TX and Rx transducers **$4/pair** 40kHz crystal **$2**

3.58MHz CRYSTALS 10 for $6

OP27 OP AMP Super op amp! **$3**

ENCODER-DECODER ICs as used in many projects, SC 12/94, EA 3/93, 3/94 AX526/7/8 **$3.50** UHF module to suit **$15**

IR COMPONENTS

IR LEDs 880nm 12º 30mW @ 100mA **10 for $9** 60º types **10 for $9**, 940nm 12º 16mW @ 100mA **10 for $5**

IR DETECTOR PIN DIODE 10 for $10

IR LASER DIODE 5mW/780nm **$16**

IR LASER DIODE 40mW/830nm **$60**

DRIVER KIT, LENS & HOUSING to suit the above IR laser diodes **$14**

LASERS

LASER POINTER PEN A pen style laser rated at 5mW/670nm. Brighter than most pens due to its high quality lens. Metal body with a tactile switch, operates from 2AA batteries (not included). Suits medical uses. **$75**

AIR-COOLED ARGONS Used 30-100mW argon-ion head blue/green output. Includes details of power supply and other information: head only: **$350** *LIMITED SUPPLY*

ARGON ION LASERS US made Argon Ion laser heads with connecting leads and matching 110V AC power supplies. Multiline units in good condition that produce over 40mW outputs. **$2200**

HE-NE LASER red laser tube plus 12V universal laser power supply kit at ridiculous prices. Used 3mW tube and 12V supply kit **$65.** 6mW tube and supply kit **$170**

VISIBLE LASER DIODE KIT 5mW 670nm visible laser diode and collimating lens, with housing and APC driver kit EA 9/94 SPECIAL **$40**

NIGHT VIEWERS

SMALL PASSIVE NIGHT VIEWER KIT Supplied with new and completely assembled USSR made scope from a binocular helmet-mounted passive viewer. EHT supply kit. Scope works in extremely low light. *Best value small night vision scope* **$290**

3-STAGE STARLIGHT TUBES Fibre optically-coupled image intensifiers with a minor blemish. Kit includes EHT supply kit, lens, eyepiece **$250** *Almost a complete starlight viewer!*

VALVE PREAMPLIFIER

Hear 'valve sound' by connecting this stereo all-valve preamplifier to your existing equipment. Can be used at line-level with guitar amplifiers, hifi, recording equipment and mixers. As used in many recording studios, but at a fraction of the commercial price. Available soon. Complete kit, approximate cost **$60!**

MISCELLANEOUS

PELTIER DEVICES Solid state, can be used to make a thermoelectric cooler - heater. Basic information included. 12V-3.4A **$25** 12V-4.5A **$35**
We can also provide two thermal cut-out switches and a 12V DC fan to suit either device **$10**

LCD CHARACTER DISPLAYS standard 16 x 1 display, 5V **$20**

IEC EXTENSION LEADS: 2m, with IEC plug and IEC socket **$5.**

3" CONE TWEETERS Sealed back dynamic 8 ohm tweeters: **$5**

12V FANS Brand new 80mm, 12V 1.6W DC fans. **$10 ea or 5 for $40**

WELLER SOLDERING IRON TIPS
New soldering iron tips for low voltage Weller soldering stations and mains operated Weller irons. Mixed popular sizes and temperatures. Specify mains or soldering station type: **5 for $10.**

LIGHT MOTION DETECTORS Small PCB assembly based on a ULN2232 IC. Can detect humans crossing a narrow corridor at up to 3 metres **$5** or **5 for $20**

HALL EFFECT SWITCH Solid state switch that reacts to the proximity of magnetic fields. Runs at extremely high speeds, up to 100kHz. Operates from 4.5 to 24V DC supply with 10mA sink-type digital output. Supplied with a suitable magnet. **$2 ea. or 5 for $8**

HALOGEN TRANSFORMER Compact (41x66x30mm) metal cased electronic transformers, 95% eff, 25kHz. Mains powered, can power up to 50W halogen or incandescent lamps. Not approved, but good for components, experimenting **$10 ea. or 4 for $30.**

12V-2.5W SOLAR PANEL

These US made amorphous glass solar panels only need terminating and weather proofing. We provide clips and backing glass. Very easy to complete. Dimensions: 305x228mm, Voc: 18-20V, Isc: 250mA. SPECIAL REDUCED PRICE! **$20 ea. or 4 for $60.** A very efficient switching regulator kit is also available: Suits 12-24V batteries, 0.1-16A panels, **$27**. Also available, a simple and efficient shunt regulator kit, **$5.**

LENS & OPTICS

PROJECTION LENS Brand new, precision angled projection lens. Overall size 210x136mm. High-impact Lexan housing with focal length adjustment. When disassembled yields three 4" diameter lenses convex-concave, convex-convex, concave. Very limited quantity. **$35**

TOMINON HIGH POWER LENS These 230mm (1:4.5) lens have never been used. They contain six coated glass lenses, symmetric, housed in a black aluminium case. Scale range is from 1:10 through to 1:1 to 10:1. Applications include high quality image projection at macro scales, and portrait photography in large formats. **$45**

FAX LENSES Small precision lens assembly as used in fax machines. Cylindrical construction: 32mm long x 25mm dia. Contains four high quality glass lenses **$5.50**

USSR LENS 100mm/f2 Pentax screw mount, for night viewers, has focus adj, but no iris adj **$60**

USSR LENS 58mm/f2 Pentax screw mount, used for cameras, has focus and iris adj **$60**

PRECISION FRONT SURFACE ALUMINIUM MIRRORS 200 x 15 x 3mm **$3** 50 x 72 x 3mm **$3**

PORRO 90deg PRISM makes a rainbow from white light **$10**

NOVEMBER 4 SALE!

Our once a year sale is on again at our premises on **Saturday 4th November 1995.**

We will have many bargains and mail order specials at the sale. **Don't miss!!**

CCD CAMERA

Very small PCB CCD camera with auto iris lens, 0.1lux 320k pixels, IR responsive, has 6 IR LEDs on PCB, almost matchbox size! **$180**
We may be able to supply a used 12V green monitor and conversion kit for an extra **$35** See SC June 95

POWER SUPPLIES

EHT POWER SUPPLY; Out of new laser printers, deliver -600V, 7.5kV and +7kV when powered from a 24V-800mA DC supply, enclosed in a plastic case **$16.**

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